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The

# Refrigeration Service Engineer

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*August, 1941*

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frigeration Service Engineer in the  
Servicing of Domestic and Small  
Commercial Refrigeration Systems  
and Oil Burners

Official Organ

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ENGINEERS SOCIETY

## COVER

The Ideal Electric Brazing being used  
for silver brazing. See article on page  
13 on "Welding in Service Repair"

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SERVICE ENGINEER

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## REFRIGERATION HAS COME A LONG WAY



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# The Refrigeration Service Engineer

Vol. 9, No. 8

CHICAGO, AUGUST, 1941

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## *The Use of* Welding in Service Repair *of Refrigeration Equipment*

By W. H. T. SVANOE\*

IN recent years manufacturers in all branches of industry have adopted the use of welding wherever possible in the fabrication of a multitude of products. In these days of sharp competition, it is a natural law of economics that the manufacturer must use the most economical, and at the same time the most efficient methods, if his business is to prosper. It is indeed gratifying to find a method of fabrication which, in addition to speeding up production and lowering costs has proved to be the strongest means of joining metals. While welding is not a new development, it is only in recent years that its potentialities have been realized, and without a doubt uses will be found for it in the future that we do not dream of today.

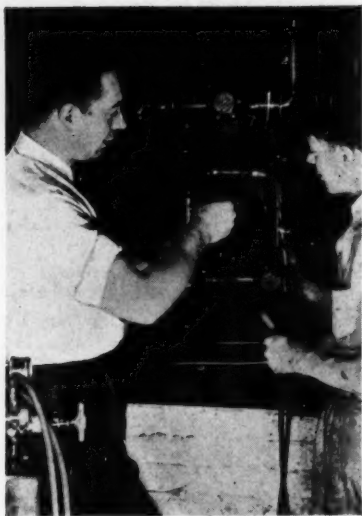
Anyone connected with the field of air conditioning and refrigeration has seen how the use of welding has been extended to include the fabrication of parts both simple and intricate which were formerly cast, bolted, riveted, or soldered. To the service man, therefore, the conclusion is obvious. If welding can be of such value in the produc-

tion of the equipment upon which his livelihood is dependent, it is only reasonable to believe that it should be of equal value in its repair and maintenance.

In following through with this line of reasoning, two questions immediately present themselves. In the first place, where can welding be used in the repair of equipment? Secondly, what means of welding is most suitable? These questions will be discussed in their order of presentation. Before taking up these questions, however, let us pause to consider briefly a condition which has a definite relation to our subject of discussion.

Refrigeration is a comparatively young industry, and there is as yet very little standardization of parts. Cataloguing and numbering of parts for various models has been sadly neglected by many manufacturers with the result that it is oftentimes impossible to order a replacement part without seeing it. Moreover, replacement parts may be impossible to obtain in cases of "orphan" makes or, in some instances, due to the manufacturer's policy. In the past, much of this equipment has been scrapped rather than investing the amount necessary to replace an entire unit with one of a different make.

\* Welding instructor at Utilities Engineering Institute, Chicago. Prepared specially for the Refrigeration Service Engineer.



The author, left, indicating pipe joint in air conditioning installation which is to be silver brazed. This will insure a permanent non-leaking connection.

Where a customer is willing to stand the cost of such an installation, the service man usually does not feel that he can charge for his services what they are actually worth, as the work could have been done at a fraction of the price had some simple part been available. It stands to reason that a man trained in the use of welding could apply his knowledge to salvaging these parts which would result in a saving to the customer and a profit to himself which would otherwise have been impossible.

It is not uncommon to see broken compressor parts, pulleys, etc., in the repair shop, nor is it unusual to see tubing which has failed in service due to conditions of vibration or corrosion over a period of time. Evaporators, condensers, etc., may fail for the same reasons. Heretofore, these parts have been replaced or (in the case of tubing, evaporators, or condensers) have been soldered where the nature of the break would permit. In many cases, unless a casting has been shattered badly, the piece may be welded at a fraction of the cost of a new part. In cases where parts are worn so badly as to necessitate replacement, such parts can very often be restored to usefulness by building up the worn surfaces by welding and then machining them to their original tolerances.

Soldering with soft solders, while perfectly satisfactory in some cases, is entirely unsatisfactory in others due to the fact that solder does not stand up well under conditions of continued vibration. Where very light parts are joined, or where a condenser or tubing is to be repaired, the process of silver brazing would be ideal as this alloy resists vibration and offers very high strength. The so-called "hermetic" or sealed household refrigeration units necessitate the use of welding if more than minor adjustments are to be attempted. These units are made with a housing which must be cut open in order to repair the mechanism inside. After the repairs are made, the housing must be welded back into its original position. Of 21 makes of refrigerators placed on the market this year, 18 have sealed units, and only three are the "open" or conventional type units. Here again, silver brazing seems to be the choice because the lower temperature of the process enables the operator to do the work without damaging the mechanism. These observations again point to the conclusion that the use of welding will not only result in higher profits but in a substantial saving to the customer as well.

#### Much Progress Made

The term "welding" embraces a multitude of processes and methods, many of which are not particularly suitable for the problems confronting the refrigeration service man. Tremendous strides have been made in the field of arc welding. Electrodes and machines have been developed which enable the skilled operator to weld sheet steel or steel alloy 24 gauge or less in thickness. Electric arc welding is not suitable, however, for joining unlike metals such as brass and copper, steel and copper, etc., examples which comprise a large percentage of the applications one might expect to find in the repair welding of air conditioning and refrigeration equipment.

By a process of elimination, other methods may be discarded until the conclusion is reached that oxy-acetylene welding is the logical choice. This welding tool is very versatile and may easily be adapted to any problem of welding the service man might encounter. Oxy-acetylene welding has kept pace with the progress of arc welding, but in a less spectacular manner. Although other processes might meet the requirements for some of the applications in the repair field, only oxy-acetylene welding will meet all of them. Furthermore, the finest oxy-

acetylene welding equipment may be had for a fraction of the cost of arc welding equipment.

### Brazing Simplifies Job

The fusion welding of iron castings is a technique not exceedingly difficult to master. Broken compressor parts, however, might need preheating because otherwise, due to the low ductility of the metal, forces of contraction might cause cracking as the casting cooled. To simplify matters, the process of "brazing" or "bronze welding" could be employed, which in the majority of cases, would obviate any necessity of preheating. A word of explanation here might be helpful. In fusion welding, the parts to be welded are brought up to their melting temperature and a filler rod of the same metal is added to make the joint. "Bronze welding" (commonly referred to as "brazing"), on the other hand, brings the base metal only up to the temperature at which the bronze filler rod will flow, which may be a temperature 1000° F., less than the melting point of the base metal.

When properly done, bronze welding will produce a joint equal to or superior in strength to a fusion welded joint. When the properly prepared surfaces are brought up to the correct temperature and bronze is flowed onto these surfaces, the molecules of bronze unite with the molecules of cast iron. This molecular union is known as a "bond," and strange as it may seem, the "bond" is stronger than either the cast iron or the bronze.

### Silver Brazing for Tubes

For the repair of tubing, condensers, and parts made of light metal, "silver brazing" is the ideal process. Silver brazing was formerly known as "silver soldering," a term still frequently used. The terminology has been changed to avoid confusing the use of silver brazing alloys with the soft solders. Some silver brazing alloys contain a certain amount of silver alloyed with copper and zinc. Others contain silver, copper, and phosphorous. These alloys are available in a variety such that melting temperatures may run from 1175° F. to 1500° F. The use of silver brazing alloys enables the operator to obtain joints of extremely high efficiency without danger of burning or overheating the base metals. To the average repair man, the use of the bronze welding process on brass or copper parts would indeed be a ticklish proposition, as the melting tempera-



A refrigeration service engineer using oxy-acetylene welding for the repair of a cracked compressor head. Note brazed crankshaft and pulley wheel and hermetically sealed unit with dome removed ready for welding.

tures of these metals are dangerously close to the melting temperature of bronze, and the fact that very light sections are used makes it very difficult to bronze weld them successfully.

In summing up the repair welding of air conditioning and refrigeration equipment, it can safely be said then, that oxy-acetylene welding is the most ideal all-around tool, and the processes used would include fusion welding, bronze welding, and silver brazing. It has not been the purpose of this paper to instruct the service man in the use of welding tools, but rather, to point out the possibilities for welding in his particular field. His fertile imagination will point out many interesting applications and many further uses for the welding process once he has become accustomed to its use.

\*\*\*

Richard L. Holt,  
Colorado.

Enclosed please find two dollars for which please send me for one year THE REFRIGERATION SERVICE ENGINEER. I think it is the best magazine of its kind on the market.

Sam Fiorino,  
Illinois.

I am a reader of THE REFRIGERATION SERVICE ENGINEER, and I can hardly wait until I receive each issue.



**A** LARGE percentage of the compressors returned to the shop for repairs are returned for such specific reasons as replacement of discharge or suction valves, repair or replacement of leaky seals, or for thorough cleaning, in the case of "stuck-up" compressors. These operations may be termed "shop servicing jobs" in an effort to differentiate from the compressor which is returned because it is noisy or inefficient and requires a complete overhaul.

It is this latter type of job with which this article will be concerned, and it is this type of work which falls more or less under the machinist's or shopman's field of endeavor, because careful inspection and workmanship of an entirely different nature to that of field servicing is required if the original efficiency and smooth operation of the compressor is to be restored.

### Dismantling

When it has been determined that the compressor must be overhauled, the first step is that of dismantling. During this time it is important that all parts be marked with a center punch or other means so that they may be reassembled again in the same relation to each other. Even on such parts as cannot be assembled in any other than the right way, it is good practice to mark them so that the habit of marking is formed. The outside castings, such as the compressor head, valve plate, cylinder block, and crankcase should all be marked in a straight line down one side, with at least two punch marks on each.

On two or more cylinder compressors, it is particularly important that the cylinders, pistons, piston pins, connecting rods, and

# The Mechanics of Commercial Refrigeration

By H. D. BUSBY,

Assoc.

connecting rod caps be marked. Cylinder number one, its piston, rod, and so forth, can be marked with two punch marks; cylinder number two with three, and so on. Furthermore, such parts as the pistons, rods, and caps should be marked in such a way that they cannot be reassembled in a position 180° from the original. In other words, it is good practice to mark these parts on the righthand side when the seal end of the compressor is facing you and reassemble them in the same manner.

### Cleaning

Degreasing and cleaning is the next necessary step, not only from the standpoint of the finished job, but also as a valuable aid in the inspection to follow. Grease, sludge, scale formation, and carbon will hinder the accurate measurement of parts and prevent a true appraisal of the work to be done. Furthermore, clean, dirt-free parts are much more pleasant to work with, and the workman's respect for the job and his working efficiency are greatly increased.

Small-mesh wire baskets, large enough to hold all the parts with the exception of the crankcase and cylinder block, are particularly useful for the cleaning operation. As the compressor is dismantled, all parts, including nuts and bolts, can be placed in the basket and submerged in the cleaning solution together. The large compressor castings may have wire handles attached to them and submerged separately. A particularly good cleaning set-up, together with the solutions to be used, was described in the June issue of *THE REFRIGERATION SERVICE ENGINEER*, page 27.

### Tools

The rebuilding of compressors will require a few extra tools over those required for service work, such as micrometers, feeler gauges, calipers, a set of expansion reamers, and a bearing scraper. Both inside and out-

# ic of Rebuilding ial Compressors

USBY,

Associate Editor

side micrometers are desirable for checking the wear on the various parts, but are not absolutely necessary, since a pretty fair job can be done with calipers and feeler gauges. The reamers will be required for fitting wrist pins, and if main bearings are to be replaced, it will also be necessary to secure a set of shell reamers mounted on mandrels to form line reamers, or purchase expansion line reamers. A running-in bench and a drying oven are other desirable equipment for the work.

## Checking, Repairing or Replacing Parts

As to whether or not worn parts should be replaced or repaired will depend on the extent of the wear, the tools and equipment available for repair, the cost of repair compared to replacement, and the availability of the repair part. The final analysis will have to be left to the shopman, since the conditions will vary from one locality to another. It can be said, however, that if a well-equipped machine shop is available to the repairman, there are few parts in a compressor, apart from broken crankshafts or cracked main castings, that cannot be repaired or replaced with a substituted part.

## Pistons

As a general rule, pistons equipped with rings should not have a clearance of more than .001 inch for every inch diameter of the piston, as measured with micrometers. When checking with a feeler gauge, use long gauges that will reach the full length of the piston, and check in four places around the piston with the piston in contact with the cylinder wall on one side and the feeler gauge inserted on the opposite side. See Fig. 1. If the clearance does not exceed .002 inch, the defective piston may be replaced with a standard piston and standard rings. If it is over .002, but not more than .004, standard pistons with oversize rings may be used. If the clearance between the piston and cylin-

**T**HIS article covers a timely subject especially in view of the fact that the curtailment of equipment and parts places an additional responsibility upon the service engineer in seeing that equipment is properly overhauled. Experienced as you may be in this work, here are some pointers to help check on yourself.

der wall is over .004, the cylinder should be honed and .005 oversized pistons and rings installed. The pistons should be tried in the cylinders as the honing progresses, and measurements should be taken to see that the clearance does not exceed .001 per inch of diameter. Such work as this will have to be done by a machine shop equipped for honing operations.

## Piston Rings

When standard size rings are being used for replacement, no fitting should be necessary; but oversize rings usually come in two or three sizes from .005 to .015 inch oversize and must be fitted to the cylinder in which they are going to be used.

To do this, the ring is inserted into the cylinder, parallel with the face of the cylinder block as shown in Fig. 2, and the gap in the ring measured with a feeler gauge. This gap should measure from .002 inch to .006 inch. Fitting is accomplished by removing the ring, filing off a small amount from the ends of the ring as in Fig. 3, and again trying it in the cylinder. Several trials are usually necessary before the proper fit is obtained. Leave the fitted rings in their respective cylinders until ready for assembly, so that they will not become mixed with those for other cylinders.

## Piston Pins

Most connecting rods are equipped with bronze bushings in the piston end, but bushings are seldom used in the pin holes of the piston. It is obvious, then, that the pin is intended to fit snugly into the piston so that it does not readily turn and have a bearing fit in the connecting rod so that most of the motion is taken up at that point. Some compressors, however, permit the pin to "float" in the piston, or in other words, the fit in the piston is the same as in the connecting rod. These pins will be distinguished by a brass tip or plug at each end of the piston





Fig. 1. Checking the pistons for wear with a feeler gauge.

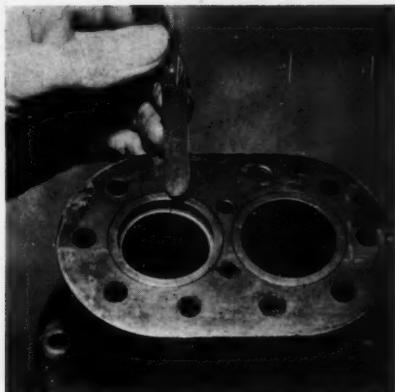


Fig. 2. Fitting piston rings in the cylinder and measuring the gap with a feeler gauge.

pin, which protects the cylinder wall from being scored when the pin moves from one extreme side to another.

Pins and bushings are cheaper than pistons; therefore, the condition of the pin holes in the piston will determine what should be done with the pins. If new pistons are being used, or if the old piston pin holes are not worn, new standard size pins should be used with new bushings. If the piston pin holes are worn, however, and the old pistons are being used, oversize pins may be fitted by reaming the old bushings (Fig. 4) and the piston pin holes to fit an oversize pin.

Pins should fit in their bushings so that they can be pressed through the bushing with a light pressure of the thumb after they have been oiled, but should not be so loose that their own weight will cause them to slide through. The fit in the piston will

be the same as in the bushing for floating pins. Non-floating pins should be fitted so that light taps of a wood or plastic mallet are required to drive the pin in; however, care must be taken to avoid having the fit so tight that the piston is forced out of shape as the pin is driven in.

#### Connecting Rods

Providing connecting rod bearings are not burned out or damaged, they do not need to be replaced, since normal wear can be taken up and the bearing refitted by removing shims from between the two halves of the bearing, if they are equipped with shims, or by removing metal from the flats of the two halves if no shims are provided. The metal can be removed by a file as in Fig. 5, or by a sheet of emery cloth laid on a flat



Fig. 3. Filing the ends of the piston rings to secure proper amount of gap.

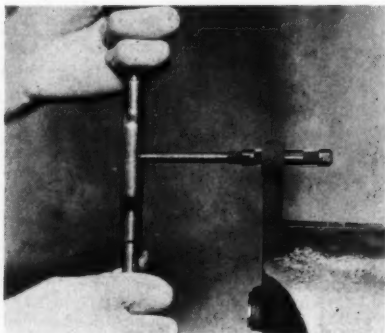


Fig. 4. Reaming the piston pin bushing to size with an expansion reamer.



Fig. 5. Showing the method of holding the file while removing metal from the flats of the bearing in order to secure a flat surface.



Fig. 6. Connecting rod bearings should be fitted so they fall slowly of their own weight with the piston assembled on the rod.

surface. Move the cap and rod over the emery cloth, using a lapping motion. When using a file to remove metal, extreme care must be used to see that an equal amount of metal is removed across the full width of the flat and on both sides of the bearing. The bearing should be checked for fit on the crankshaft, as the removal of shims or metal progresses, and enough should be removed so that the bearing fits tightly.

The real job of fitting begins at this point, and is done by scraping the bearing until the desired fit is obtained. The process of scraping, while a tedious one, is not difficult, requiring only patience and some degree of care to do a good job. The crankshaft journal is smeared with a light coating of Prussian blue, just enough to color the shaft, and spread evenly over the entire surface. The two halves of the bearing are then clamped together in the usual manner with bolts, care being taken to have the two halves matched according to the marks punched on them while dismantling, and to have them turned in the same direction as originally assembled. Turn the rod on the crankshaft several turns to indicate the high spots of the bearing surface.

At the start of the process of scraping, the bearing may seat at only a few points. Continued scraping and testing on the shaft will bring the bearing surface practically across the entire width of the bearing. The process may be considered complete when a bearing surface is indicated over about 75% of the total bearing.

The high spots on the bearing are indicated in blue, as where the shaft does not bear on the bearing, there will be no color. The high spots are removed by means of

scrapers which may be purchased from any tool supply, or made by hollow grinding the three sides of an old three-cornered file. To scrape properly, the scraper should be kept very keen by rubbing on an oil stone.

The number of times the bearing must be applied to the shaft for remarking is important to the total time required for fitting. The time required to complete the fitting depends largely upon one's judgment in reading these marks. In the early stages of scraping, the marks should be used partly as a guide for showing high areas, and instead of merely scraping the marked spot, the surface surrounding it should also be reduced unless it is evident that the unevenness is local. The idea should be to obtain first a few large, but generally distributed, marks; then an evenly and finely spotted surface can be produced quite easily.

The final fit of a babbitt bearing should be just tight enough so that when the rod with the piston assembled to it is placed in a vertical position as in Fig. 6, it will slowly fall of its own weight. Babbitt bearings may be tighter than bronze bearings because the high spots on the softer babbitt soon wears down to a smooth surface. The bearing should have oil on it during this test.

If the bearing is damaged or burned out, it is usually cheaper to purchase a new connecting rod complete or new bearing inserts, depending on the construction of the rod. When these are not obtainable, it may become necessary to have new inserts machined from bearing bronze, or poured with babbitt. If the new bearings are undersize as you receive them, it is advisable to ream them to size before scraping.

*(To be continued)*





R. A. Fuller

# Fundamentals of Motors

By R. A. FULLER \*

Here is a simple, highly instructive explanation of the design and operation of the various types of motors, and even though you may be quite familiar with motor principles you will find much of interest in this article.

**A** THOROUGH understanding of the equipment with which we work contributes greatly to our effectiveness. Those of us who use motors will therefore benefit by obtaining a clear picture of the principles involved in their operation.

A discussion of this subject must have a foundation—facts that are recognized by all of us. For these basic facts let us turn to the children's toys, other novelties, Boy Scout experience and automobile accessories. From such things we have all gained some experience with permanent magnets and with compasses.

We know that the earth is a huge permanent magnet, that the North magnetic pole is somewhere near Hudson's Bay and that the compass points toward that magnetic pole. The compass is thus an indicator of magnetism, as shown in Fig. 1, pointing at one end of any permanent magnet and away from the other end. These ends are called the poles of the magnet. If we have several permanent magnets we can determine the pole of each, toward which the compass points, and mark it as shown.

If we bring the marked end of one magnet close to the marked end of another one, we find that the magnets tend to push apart. This demonstrates the fact that like poles repel each other. If we bring the marked end of one magnet close to the unmarked end of another one we find that the magnets tend to pull together. Thus we learn that unlike poles attract each other.

Fig. 2 represents a simple coil of wire connected to a battery. Here we find that the compass points at one end of the coil but that, if the battery connections are re-

versed, the compass points away from that end. Reference to Figs. 1 and 2 shows that the same effects are obtained with permanent magnets or coils. Thus, in our discussion, we can use them interchangeably.

Usually coils are wound on iron or steel cores. The purpose of the iron or steel is simply to aid the coil, making the magnetic effect stronger.

## Direct Current Motors

Fig. 3 illustrates two permanent magnets, one of which is held stationary while the other is free to rotate. As unlike poles attract each other, the free magnet tends to rotate in a clockwise direction until the magnets are in line. If the free magnet is then removed from its pivot and replaced, so that like poles are together, the free magnet will continue to rotate clockwise due to the repulsion between like poles. This is a crude representation of a direct current motor.

Let us now replace the free magnet with a coil, as shown in Fig. 4. The large arrows represent brushes through which the battery current flows to the coil. When the end of the coil passes under the permanent magnet, the brushes reverse the connections of the battery to the coil. We thus automatically obtain the change in magnetic polarity, that was made manually in Fig. 3, and have continuous rotation. There is a dead spot, when the coil and permanent magnet are in line, where no rotating force is developed. A more elaborate construction is required to eliminate this condition.

A ring of iron, as shown in Fig. 5, is wrapped with one continuous coil of wire. The insulation is removed from the outer surface of these wires so that the brushes

\*Industrial Engineering Department General Electric Co.

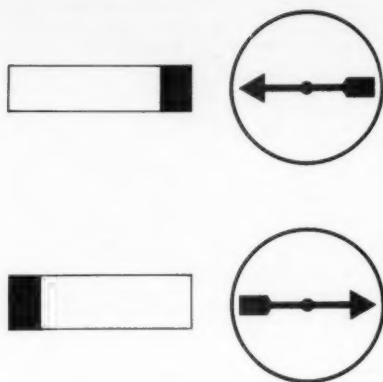


FIG. 1.

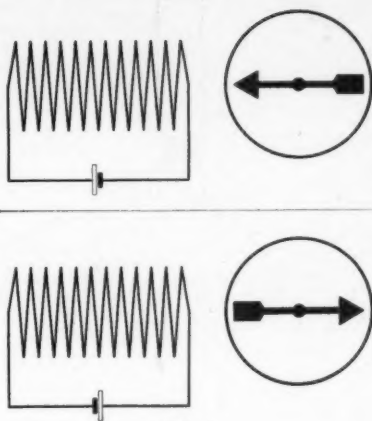


FIG. 2.

can make contact with them. This iron cored coil is mounted on some sort of a spider and placed on a pivot so that it is free to rotate. A battery is connected to the brushes and a stationary permanent magnet is used as in the preceding diagrams.

At the right-hand brush location, the ring develops the magnetic polarity we have previously indicated by the marking on the ends of our permanent magnets. At the left-hand brush location, we have the polarity previously indicated by no marking on the ends of the permanent magnets. The left-hand side of the ring is therefore drawn toward the permanent magnet and the right-hand side is repelled so that clockwise rotation is obtained.

As the ring rotates the brushes are continually transferring the battery connections from one wire to the next. This maintains the magnetism, as covered in the preceding

paragraph, so that the force, tending to rotate the ring, is maintained. There are no dead spots as in Fig. 4.

This ring construction is expensive and mechanically complicated. The rotating part, called the armature or rotor, is usually made as a cylinder of iron with the wires inserted in slots in the surface of the cylinder. The windings for these armatures are somewhat complicated. Their purpose, however, is simple—that, with the brushes and commutator, they will maintain the magnetic polarity of the armature as is the case in Fig. 5. This is accomplished by so arranging the winding that the current is always flowing in the same direction in all wires, located between one brush and the next one, as you progress clockwise around the armature. After passing the next brush the current is always flowing in the opposite direction in all wires.

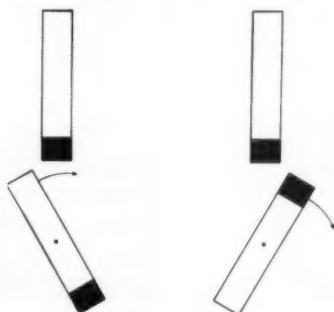


FIG. 3.

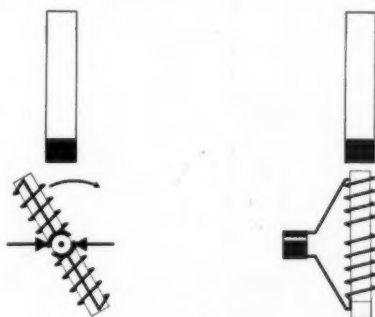


FIG. 4.

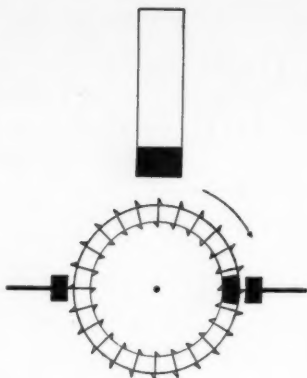


FIG. 5.

### Three Phase Motors

Fig. 6 represents three stationary coils connected to a three phase power supply. Three phase power is such that current flows strongly in line 1 first, then in line 2, then line 3 and then in line 1 again. Thus coil 1 becomes magnetically strong first, then coil 2, then coil 3, then coil 1 again, and so on. This operation can be represented by a permanent magnet which is placed on coil 1, when that is strong, then on coil 2, then on coil 3, then on coil 1 again and so on. It will be observed that this magnet is rotating about the central point of the diagram and it is from this that the expression "rotating field" is obtained.

A synchronous motor is one in which the rotor keeps exactly the same speed of rotation as the rotating field. The rotor con-

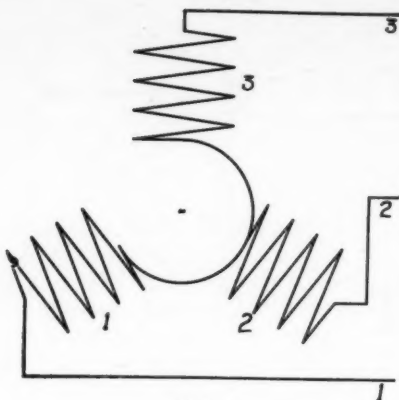


FIG. 6.

sists of a coil energized by direct current which, from the discussion of Figs. 1 and 2, can be represented by a permanent magnet. Fig. 7 shows such a magnet B, pivoted at its center, with another permanent magnet A representing the rotating field. Rotation of A causes B to rotate and the two magnets turn together—locked together magnetically. Such a motor has low starting ability and is usually made so that it can be started as an induction motor.

An induction motor, as most commonly used, has a squirrel cage rotor as shown in Fig. 8. This consists of a number of metal bars connected at each end to metal rings. Although not shown, the bars are imbedded in iron to increase the magnetic effect. The rotating field is represented by magnet A as before. Rotation of magnet A, past the rotor bars, develops current in

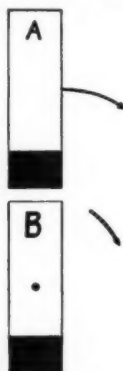


FIG. 7.



FIG. 8.



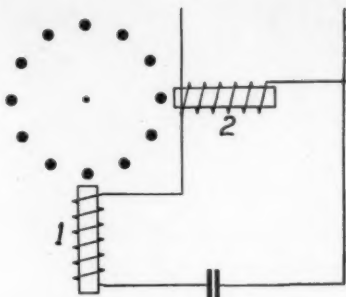


FIG. 9.

the bars. This current causes magnetism in the squirrel cage "winding" such that it follows magnet A. As magnet A must pass by the rotor bars in order to generate the rotor current, the squirrel cage rotates slower than magnet A. This difference in speed of rotation is known as the slip.

A two phase motor is essentially the same, in principle, as a three phase motor. It may be represented by omitting coil 3 from Fig. 6. The descriptions of the synchronous and induction motor operation are then as given above.

The reversing of a three-phase motor is accomplished by exchanging any two leads. For example, exchange lines 1 and 2 in Fig. 6. We now find that coil 2 is strong first, then coil 1, then coil 3 and then coil 1 again. The rotating field has thus reversed its direction of rotation.

Fig. 9 shows two stationary windings, connected to a single phase line, with a squirrel cage rotor. The capacitor, con-

nected in series with coil 1, has the peculiar characteristic of making coil 1 magnetically strong earlier than coil 2. Thus we have coil 1 strong first, then coil 2 and then coil 1 again. This is the same as the two phase motor previously covered and we have a ro-

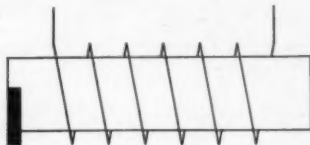


FIG. 10.

tating field effect which rotates the squirrel cage. As the capacitor is permanently in the circuit this is known as a permanently split capacitor motor. It is used chiefly for small fan motors. Capacitors for this continuous service are expensive and bulky so that it is not economical to make this motor for heavy starting duty.

Fig. 10 illustrates a coil with an iron core to increase the magnetic effect. Part of one end of this core is surrounded by a heavy copper loop known as a shading ring. This ring has the characteristic of delaying the flow of magnetism through it. With alternating current applied to the coil, the magnetism is strong first at A and then, slightly later, at B. As shown in Fig. 11, this gives a rotating field effect that drags the squirrel cage rotor in the direction in which the shading ring points. This is known as a shaded pole motor. Because of the limitations of force and current possible in shading poles, it is not feasible to build efficient motors of this type larger than those used for small agitators and fans having horsepower requirements of  $\frac{1}{3}$  horsepower or less.

A single phase motor, for heavy duty service, is somewhat different from those previously discussed. Fig. 12 shows a single stationary winding with a squirrel cage

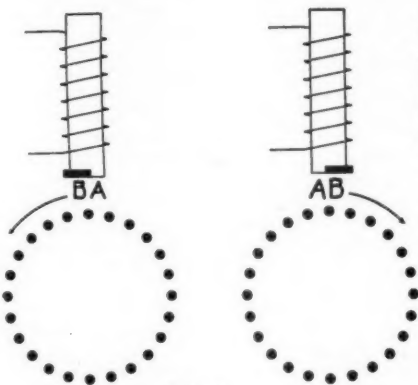


FIG. 11.

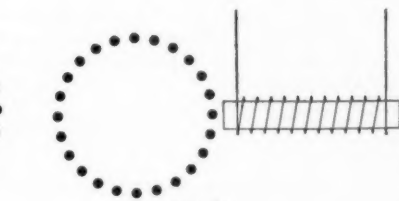


FIG. 12.

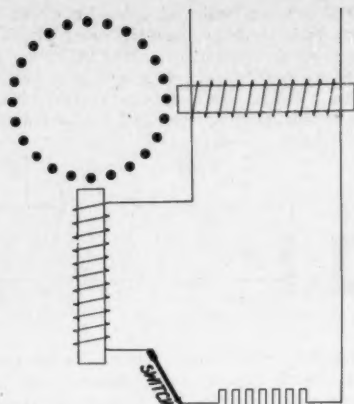


FIG. 13.

rotor. It can readily be demonstrated that such a motor will run, and develop plenty of power, if it is started rotating by hand. It will also be noted that it will do this in either direction of rotation. (This is an interesting experiment that can be easily performed by disconnecting the starting winding of a resistance split phase, or capacitor, motor. See below for further reference to these.) From such a demonstration it becomes evident that the real problem on these motors is to start them.

Another winding, known as the starting winding, is added as shown in Fig. 13. A resistor is connected in series with this starting winding. This causes the starting winding to get strong first, then the main winding gets strong, giving a two phase rotating field effect for starting. When the motor reaches approximately three-quarters of its rated speed, a switch opens to disconnect the starting winding from the line. The motor then runs as shown in Fig. 12. This is known as a resistance split phase motor and is commonly used on washing machines. It is not practical to build such motors for the heaviest types of starting duty.

For such service as refrigerator and air compressor drives, where the starting duty is severe, a capacitor is used in series with the starting winding as shown in Fig. 14. This results in a rotating field effect as covered in Fig. 9. The starting winding is disconnected at three-quarters speed by the switch as in the case of the resistance split phase motor. The capacitor motor has greater starting ability than the resistance

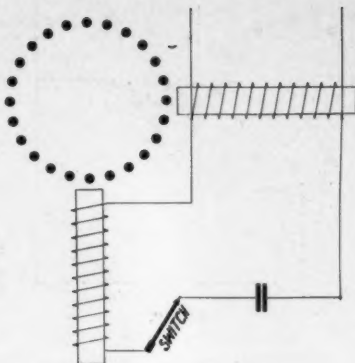


FIG. 14.

split phase motor. As the capacitor is only in use during starting, a high capacity can be obtained economically by selecting it for this short time duty.

The repulsion start-induction run motor is operated in various ways. In the running position, the brushes may be or may not be raised. If the same rotor winding is used for starting and running, the commutator is short circuited at about three-quarters speed to obtain a rotor winding approximating the squirrel cage in its functioning. Other designs have two rotor windings—a squirrel cage and a wound winding for running and starting respectively. In this type, no rotor mechanism is required as the magnetic conditions automatically transfer the burden from one winding to the other as the motor comes up to speed. This type is commonly known as the repulsion-induction motor. From this discussion it is evident that the running conditions are as covered in Fig. 12. Again it is apparent that the real problem is in the starting of the motor.

There is another electrical principle that will be useful in discussing repulsion starting. Fig. 15 shows a wire, stretched across the face of a magnet and connected to a battery. Under these conditions there is a force on the wire which, for example, tends to move this straight piece of wire upward. If the connections to the battery are reversed this wire tends to move downward. Thus we can demonstrate that a current carrying wire, in a magnetic field, has force on it tending to move it in a certain direction. Also that, if the direction of current flow in the wire is reversed, the force and motion are in the opposite direction.

(Continued on page 46)

# COMMERCIAL

INCREASE BUSINESS BY  
DOING A MORE EFFEC-  
TIVE JOB OF SELLING

# *Selling*

## How to Work with the Chain Stores

*By Allen R. Carter*

Combining the personal service the chain store needs, along with other commercial work requires careful handling.

ONE OF THE gravest situations facing the refrigeration service engineer is the trend of the chain stores to establish their own service departments. This is particularly true of those chains which present the most profitable possibilities—the ones with their own ice cream plants, candy factories, bakeries, etc., that require a good deal of service in addition to their retail units.

For that reason the experiences of R. L. Schuck of the Vernon Refrigeration & Electric Company, 5408 South Santa Fe, Los Angeles, should be of interest to readers. Mr. Schuck does the service work for the largest local grocery chain which operates its own meat storage, bakery, candy factory, etc., in addition to about five hundred stores in Los Angeles.

Vernon Refrigeration & Electric Company also has a number of other local chain stores for whom they do all the service work. While this firm has not particularly concentrated on service work for the multiple-unit operators, Mr. Schuck reports that this requires a separate type

of operation if it is to be handled successfully and with satisfaction to the customers.

First, it requires a great deal of personal attention. Whereas the smaller, one-unit operator does not expect to receive personal attention, the chain store that has many outlets recognizes its position and therefore can always more or less hold the threat to establish its own service department as a club over the head of the independent company. While this may not be expressed in so many words it is nevertheless there in actuality and must be met decisively.

The only way this can be met decisively is to convince the local office of the chain that it would be uneconomic to establish their own service department. This is particularly true now that the National Defense effort is absorbing so much in tools and equipment.

The situation should be met squarely on the initial contact by dealing with it *before* the management has an opportunity to think of establishing its own service department. Once management has been convinced that this procedure is uneconomic on the basis of facts and figures which the service engineer can present, then the door is open to obtaining the account.



## Better Labor Utilization

In this connection the question of a higher utilization of labor has an important bearing on swinging the chain away from contemplation of its own service department. More successful utilization of labor is one of the primary concerns of all large chains and if the service engineer can show the management that it is by utilizing his shop-labor rather than setting up their own shop that more value per dollar expended on labor is obtained then he can expect to forestall the move.

It is permissible to presume, first, that a shop concentrating on one chain only will not be able to keep workers busy all the time and, secondly, that closer supervision of labor and labor costs will be exercised by the independent management than by a manager who is hired to do this work.

But facts and figures must be correlated to show the differential, it has been found, and if only a 1% or 2% savings can be effected the chain management will move in the direction of that saving—since their whole calculation is based on a multiplicity of small savings on the basis of volume operations.

Once management has been convinced and the first contract signed, it is necessary to study and understand the particular field of work to some extent. Chain practices and procedure should be understood in a broad way so that in contacts with the individual store managers and the supervisors, who usually work under the district management over a group of stores within the district, the service engineer has a general grasp of the particular field and the problems which the chain store managers and supervisors face.

In this connection, much information can be obtained by making friends with one or more of the local supervisors. Since the engineer is more or less "working for the company" they will be willing to discuss problems and in this way the engineer will have a broad grasp of conditions in the field that will enable him to tackle the job more intelligently.

While the above are questions of personal relationships rather than of skill and

service, they are nevertheless most important as affording the broad basis upon which effective service can be built.

## Take Over All Work

With this established, the refrigeration service engineer will then proceed to take over all equipment and work, checking carefully at regular intervals in order to cut down any complaints that may arise.

The substance of this approach is that chain management expects that the service engineer will relieve them entirely of all responsibilities on the score of their refrigeration equipment, installation, tearing out when the stores move, re-installing at the new locations, etc.

The system which has been developed at Vernon Refrigeration & Electric Company is to use the "stand-by" method. They keep several models of whatever type of machine the chain is using on hand at all times. When anything goes wrong in the store, they put a stand-by unit in and bring in the regular machine for repairs or overhaul. By going over the machines thoroughly it has been found that much running back and forth to service can be eliminated while at the same time keeping all the machines in better order so that there are fewer calls for service.

Finally, the service engineer should act as a "controlling agent" for the chain management, keeping accurate records of all their equipment and checking this frequently with headquarters. They also should be prepared to provide sufficient storage space for all parts and equipment belonging to the chain—in short, functioning in so far as possible in the same manner as would a refrigeration-service department operated by the chain itself.

In this way, the connection becomes much closer. In addition, this has been found the most productive way to handle the work. Requirements are somewhat "stiff" it is true, but the amount of volume to be obtained in servicing chain store equipment makes it profitable for the service engineer to meet these requirements, basing himself on volume of work obtained to insure a reasonable profit on labor expended.



# Specialize for Profit

*By Robert Latimer*

**P**ERHAPS the most logical means for the commercial refrigeration service firms to emerge from today's highly competitive field with a consistent profit is to specialize, according to Howard Mitchell and Melvin Reed, co-partner operators of the Refrigeration Maintenance Company, outstanding commercial refrigeration service company of Denver, Colorado. However, such specialization always has one untoward effect—that of cutting off the service firm from potential profits in other fields, which might be well handled if some definite selling and contracting system could be applied.

Refrigeration Maintenance Company occupies a unique position in the Colorado capital simply because Mr. Mitchell and Mr. Reed have refused to retire to one field of service—and have instead chosen three profitable service fields as their market, built up an integral specialty in each line, and aggressively "sell" it to prospects. As a result, even the name of the firm was changed, and the company has been able to enlarge considerably without taking on excessive overhead of any kind.

"We handle only three types of refrigeration service, and that exclusively on a contract basis," Mr. Mitchell explained to the field editor of the *REFRIGERATION SERVICE ENGINEER*. "We spend as much time as possible in making sales calls, and never take a contract until we're certain that the customer is fully satisfied that he is getting his money's worth. That point involves a great deal the ultimate success of the firm—for whenever the customer thinks he is paying too much for the guaranteed operation of his refrigeration, goodwill is in danger, as well as profits."

Refrigeration Maintenance Company is consequently as much a sales organization as service. Partner Reed spends all his time in selling, calling on prospects, explaining the contract system by which his

firm's business is conducted, and following up leads. Mr. Mitchell operates the shop, dispatches repairmen, and keeps contracts fulfilled. At present, the shop turns down around 10 service calls per day—because contract service takes every minute of the working day, and often more besides. "We stick to contract alone" is more than a slogan here.

Three specialized services are involved, including air conditioning of large tonnage, commercial refrigeration in stores, and apartment house multiple systems. During the summer, 50% of business is air conditioning, the remaining two split equally the year around. Mr. Reed himself sold 90% of these contracts following service calls, and in some instances, took on contracts where other firms had attempted a contract of some sort and failed. "We're confident in our men and our work," Mr. Mitchell explained. "So that we can take on almost anything but ammonia systems with surety." With six servicemen, Refrigeration Maintenance Company has now 150 regular contracts in Denver.

Air conditioning, as a major service, is contracted for on a monthly basis, because of Denver's short three-month warm season. To theatre owners, store operators, etc., Mr. Reed sells a complete maintenance service, including a checkup every two weeks, start up and drain-down service, and complete adjustments, at a flat rate of \$1 per horsepower per month up to 50 tons, adjusting the rate above that figure. This rate guarantees operation except for parts cost, and can be applied anywhere in Denver because the firm has facilities for repair and adjustment of wet-spray cooling, evaporative types, refrigerated and well-water air conditioning, all of which are found there. Mr. Mitchell has never lost a cent on conditioning contracts; gives 24 hour service,



★  
Mr. Mitchell in front  
of the Refrigeration  
Maintenance Co.'s  
Denver Store.  
★

and won a Carrier authorized franchise because of excellent work.

Commercial refrigeration, second most important specialty, is charged at \$1.25 per horsepower, and involved supermarkets, grocery stores, small department stores, delicatessens, drugstores, restaurants, and seafood stores. Almost all this contract business was sold as the result of individual service calls, when complaining owners were presented the idea of guaranteeing operation at a flat rate. Refrigeration Maintenance Company uses a special car for this service, has a blueprint plan of every customer, and services every piece of equipment at least once a month, most every two weeks. Proof of good service lies in the fact that many "tough customers" listened to the recommendations of friends and made contract arrangements afterwards. Twenty-four hour service is also extended here, as is a rolling parts inventory which can repair breakdowns in a few minutes, carried in the commercial refrigeration service car.

Finally, the Denver service firm has a novel specialty worked up in apartment house refrigeration. Denver still has hundreds of multiple system refrigerators in apartment houses, and Mr. Reed estimates that he has at some time or another been in every apartment house in the city—always selling contract service as an ideal solution to frequent difficulties. In this

field, where many other refrigeration firms have failed to "deliver" Refrigeration Maintenance Company excels—making a flat rate charge of 50 cents per unit on multiple systems, slightly more on individual boxes (the company also sells Stewart-Warner replacement refrigerators to apartments). Longer working hours and more arduous labor in keeping multiple systems in good running order have been the result—but it has paid a consistent profit, according to both partners.

Service charges made by Refrigeration Maintenance Company are unvaryingly higher than competitors—\$2.50 an hour for labor, 75 cents for the call—but are deliberately kept so because the firm has so little time for individual repair jobs. Most of these are taken solely because they offer opportunity to increase the number of contracts on hand. "We have as much as we can handle," Mr. Mitchell summed up. "But naturally, can expand our shop later on if it appears we can add more contracts or another branch of service." No domestic refrigeration service is handled whatsoever. The company runs a large telephone directory ad, which lists all its services and contract arrangements—but in the main, it has been "cold canvassing" and following up of complaints from refrigeration or conditioning operators which has produced this three-way specialization.

# One-Year Guarantee Strongest Used Refrigerator Selling Point

A-Ace Refrigeration Service Co. finds most of its customers buy from them because of their one-year guarantee. 30-day warranty is usual in Kansas City area.

*By B. K. Anderson*

**"BECAUSE** we give a one-year guarantee of service with all of the used refrigerators that we sell, we seldom lose a prospect to a competitor and we have substantial proof that we make sales that without this guarantee would have been impossible.

"Also our selling price is from 10 to 20 per cent higher than the market in our area and we are able to get it without trouble again, for this same reason, our one-year guarantee of service."

So explains Mr. I. A. Greathouse, owner and manager of the A-Ace Refrigeration Service Company, Kansas City, Mo., who is convinced that used refrigeration has the same place and possibilities in the refrigerator market that used cars have in the automobile industry; and brings out his records to prove that "not only is the service cost on this guarantee very small, but it is the guarantee alone which adds the weight necessary to make the sale."

A-Ace is primarily a refrigeration service firm. They do not have a showroom or sales floor from which to merchandise their used boxes and they have no intention of adding either of these units to their operation and merchandising. Mr. Greathouse's reasons for this are exact:

"We have no desire to set ourselves up as competition for the refrigerator dealers of our area. In the first place most of our refrigerators are trade-ins which we purchase with service or cash from these dealers and as direct competition their price to us would necessarily be higher.

In the second place we are a refrigeration service firm; our interest is not in selling a volume of units, but in selling a volume of service.

"By selling used refrigerators on a one-year guarantee we are selling primarily service. We are not selling a certain model, a certain style, a certain brand, or ideas such as 'Make your kitchen more beautiful' or 'This model holds 50% more.' We are selling guaranteed refrigeration and nothing more."

It is for this reason, Mr. Greathouse points out, that A-Ace concentrates its attention and its rehabilitation dollars on the operation of the unit rather than its appearance. As reasons for this he lists the following:

1. With most buyers of used refrigeration, appearance is of secondary importance.

2. Often to insure a complete shop overhaul of the refrigerating unit it is necessary to spend \$15 or \$20 on labor and parts and no more than this amount can profitably be put into preparing the used unit for market.

3. More than half the refrigerators traded in to dealers were replaced because they were not operating efficiently, thus it is the mechanical rather than the appearance factor of the unit that really needs the attention to make the same refrigerator satisfactory to another customer.

4. The reason why dealers usually only give one-month's guarantee on used units is that service costs would take all the profit out of their deals, judged on the same basis as applied to sale of new refrigeration. The service firm, with usually a much more complete stock of

parts and facilities for testing and re-newing the unit, can well afford to stand behind its jobs, just as it does in the repair field.

"In a few words," Mr. Greathouse says, "service firms are selling their specialty when they sell used refrigerators. They know the refrigerator they sell will give satisfactory service because they have prepared it to that end. The service firm does not need extensive sales promotion such as costly showrooms and high-powered salesmen, because actually that point, which is deciding the customer in their favor, is located in the shop not on a display floor."

### Price Must Be Maintained

Certainly A-Ace, like many other service firms which have entered the market of retailing used refrigerators, have run across a large number of prospects who expect to pick up an "old second-hand box" for around twenty or twenty-five dollars. Their reply to this customer is simple: "Any refrigerator which it worth guaranteeing a year is worth approximately 50 per cent of the selling price of new units of the same size."

This criterion applies generally as the firm's pricing policy with the exception of cases where the refrigerators are less than five years old. It has been A-Ace's experience that about 40 per cent of this latter group have been traded in because of moisture in the refrigerating unit, resulting either from improper service attention or failure of the unit mechanically.

"These refrigerators less than five years old usually can be brought quickly to a 'like new' appearance and once the actual cause of their failure is determined and corrected, they are fully worth—and we get—up to two-thirds of the 'new' price," Mr. Greathouse explains.

A check of A-Ace's used refrigerator sales record shows that: out of 100 used machines reconditioned in this shop, 50 will call for service during their year's guarantee period; the sale of one in a neighborhood may result in as many as five or six prospects contacting the company regarding similar units for themselves; service calls are the most productive of sales, par-

ticularly if the customer owns an 'orphan,' a very old box or one that has seen hard usage and costly repairs are indicated.

Classified advertising in the newspapers and yellow sections of the telephone book stating simply that the firm sells used refrigerators and that it guarantees them for one year, are inexpensive and productive of good results. Also in some cases, it is profitable to let the dealer sell these units for the service firm on a 10% commission basis.

Best sources of refrigerators for reconditioning are the dealers—on a basis of "I'll take two of your trade-ins. I'll repair one for you and keep one for myself for my service charge—and trade-ins which the service man receives on his sale of the reconditioned used refrigerator."

A-Ace has found that these units may be sold almost equally as well in the winter as in the summer. Consequently most of their merchandising in this category is planned for the months after the peak summer season is over, when there is slack in the shop and this work can be done at the lowest cost.

According to Mr. Greathouse: "This reconditioning not only keeps our service force sales-minded but gives us an even flow of work the year-around. I believe service men are the best possible used refrigerator salesmen, because what they are selling is service and that's the one thing they really know and can talk about."

\*\*\*

### MAY LOSE EYESIGHT

*In spite of the many safety appliances available on the market and the many warning articles and instructions on safety, accidents such as the following still occur. Seems unnecessary does it not?—Editor.*

**A**N employe of an electric refrigerator dealer in Wolfeboro, N. H., may lose his eyesight as the result of an accident which occurred while he was repairing a refrigerator.

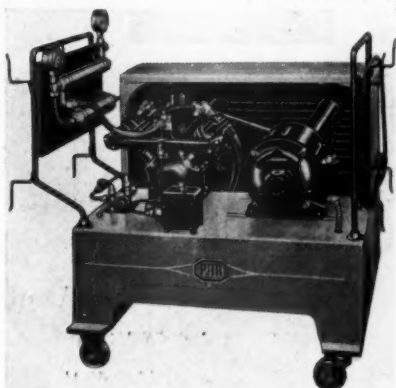
Refrigerating fluid burst in his face, severely burning both his eyes and the inside of his mouth. Doctors found no evidence, however, that the man had inhaled or swallowed any of the fluid.

# New and Improved Appliances

Information contained in this department is furnished by the manufacturer of the article described and is not to be construed as the opinion of the Editor.

## Par Portable Refrigeration Plant

**MODERN EQUIPMENT** CORP., Defiance, Ohio, manufacturers of Par commercial refrigeration units are now in production on a new type of equipment of special interest to operators of eutectic-plate-equipped transport vehicles.



This new unit, designated as the "Par Portable Condensing System" is available in  $\frac{3}{4}$  hp, 1 hp and  $1\frac{1}{2}$  hp heavy duty either 110-220 volt, 60 cycle, single phase

or 220-440 volt, 60 cycle, 3 phase models. The unit is a complete refrigeration plant, compact in design, and mounted on a streamlined base with heavy duty casters for easy portability, and it includes liquid indicator, filter dryer, heat exchanger, high and low pressure gauges, and 25 feet of electric cable.

Eutectic-plate-equipped trucks for transporting ice cream, meats, dairy products and other perishables are furnished with flexible liquid and suction lines which can be attached permanently to

the heat exchanger.

The manufacturers claim that this new portable unit is the first one of its kind to be offered for servicing transport vehicles.

## Silver Solder Brazing Unit

A NEW Electric Brazer for brazing and soldering with silver solder is announced by the Ideal Commutator Dresser Co., 1093 Park Avenue, Sycamore, Ill.

This Brazer operates on the same principle as the popular Ideal "Thermo-Grip" soft soldering tools. It consists of a power unit or transformer and a pair of electric heating pliers. Holding the part to be brazed in the pliers, closes the secondary circuit causing the part to quickly heat to

brazing temperature. Heat is accurately controlled by on-off foot switch.

The Ideal Brazer is compact, portable, easy to use and always ready in shop or field. When in use the cover turns back making a convenient shelf for flux, silver solder, etc. Compartments are provided for heating pliers,



foot switch, silver solder and flux. When not in use all parts can be enclosed and out of the way in the streamlined cabinet which is readily portable on easy rolling casters. Overall size is only 14 x 12 x 25 inches. Weight, 100 lbs., (60 cycle unit), 150 lbs. (25 cycles).

The Brazer operates on 230 volt, 50-60 cycle power supply. 440 volt and 25 cycle units are also available. Rating is  $7\frac{1}{2}$  kva. Secondary voltage is reduced to only 10 volts. Heating pliers have  $6\frac{1}{4}$  inches long throat. Face of carbon is  $1\frac{1}{4}$  x 2 inches but may be filed to shape best suited for a particular job.

Uses for this revolutionary tool are almost unlimited. Wherever soldered joints are now made in motors, transformers, electrical leads, lugs and terminals, bus bars, automobile engines, aircraft engines, water heaters, fittings, carbide tool tips, band saws, etc. the Ideal Brazer now makes possible the use of silver solder.

Walter M. Boone  
California.

Enclosed you will find a Postal Money Order in the amount of \$2 for renewal of my subscription to THE REFRIGERATION SERVICE ENGINEER, a serviceman's service magazine.

# MR. SERVICE ENGINEER

*You're in The Driver's  
Seat* **NOW!**

Today's emergency is every Service Engineer's opportunity **AND WELCOME RESPONSIBILITY!** The job is to keep refrigeration systems running to conserve America's food at home and for the U.S. Armed Forces...to protect America's health for national defense...to save tons of material urgently needed for essential defense production...to reduce electric power consumption by maintaining efficient operation.

Uncle Sam has given **SERVICE** the right of way over **SALES!** You are in the driver's seat with your knowledge, your experience, your mechanical ingenuity and your ability.

In Army Camps, aboard Submarines, Battleships, Destroyers, in Navy Barracks and in all types of commercial and domestic electric refrigeration systems you will be continually running into familiar Fedders Refrigeration Products. You'll be right "at home" with any Fedders equipped system!

**f**  
**edders**



# ENGINEER.



**MANUFACTURING CO., BUFFALO, N. Y.**

Atlanta, Boston, Chicago, Cincinnati, Dallas, Detroit,  
Los Angeles, New York, Philadelphia, St. Louis, Hamilton, Ont.



# What Must Be Done—

How we can help to help ourselves. We must devise ways and means to provide uninterrupted refrigeration service in the face of emergency conditions. Let's work together.

- ★ **Maintain good credit relations.**  
(You can pay your bills only if you collect your accounts promptly. Today your credit standing with your supplier is more important than ever.)
- ★ **Don't tolerate overdue accounts.**  
(Now, of all times, see that accounts due you are not delinquent. You need this money to keep your credit good.)
- ★ **Protect yourself against increased prices.**  
(Catalog prices are frequently changing. Check carefully.)
- ★ **Return refrigerant drums promptly.**  
(Check up on refrigerant drums and return them to your supplier quickly. Avoid the situation of no drum—no gas.)
- ★ **Allow more margin on equipment sales.**  
(In figuring jobs, protect your margin of profit due to increased costs.)
- ★ **Expect variations in materials ordered.**  
(Substitutes may be necessary, so anticipate such changes.)
- ★ **Cooperate with your jobber.**  
(Some rationing of parts and supplies may be necessary. Jobbers are making a practice of supplying their regular customers first. Stay with your present source of supply for best service.)
- ★ **Don't try to over-order.**  
(This has a tendency to create false demands.)
- ★ **Don't accept business that won't return a fair profit.**  
(Your time is your profit. Today you can't afford to transact business at a loss. Make every job profitable.)
- ★ **Be careful about making definite promises.**  
(Check carefully before making commitments. Ascertain first if you can get all the materials necessary. Your customer will understand.)

ALL business, large and small, is compelled, under the present emergency conditions, to adopt new methods of business procedure and be flexible enough in its operation to meet new situations as they arise.

A great responsibility is placed on the refrigeration service engineer. Equipment must be kept operating and it is up to us to see that the best service is performed in spite of unprecedented conditions. Follow some basic rules in organizing your business to conform to present conditions.

The listed suggestions do not include all of the necessary steps that the service engineer and installation contractor should adopt, whether he is operating his own business or employed. They are intended to point out how you can help to help yourself. They are listed to show what is essentially necessary in the present situation. Read them carefully.

Domestic refrigerator production has been reduced fifty per cent for next year. OPM has ordered that makers of repair and maintenance parts for household equipment be given preference in obtaining materials over manufacturers of other civilian goods. This allocation program is expected to reduce to a minimum the inconvenience to the public caused by diversion of raw materials. Repair parts, both domestic and commercial, now carry A-10 priority.

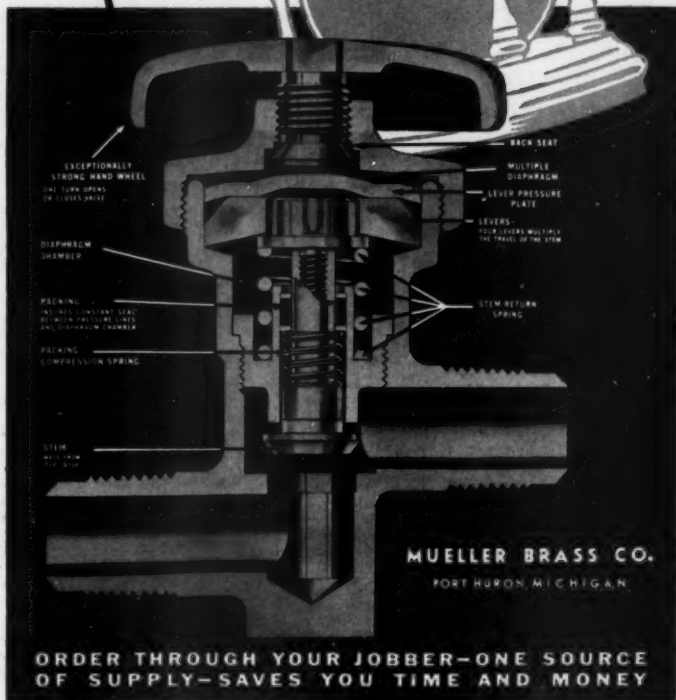
Considerable pressure is being exerted to point out to the government bureaus in charge of allocating materials the position that the refrigeration industry occupies as a "first line of defense" in maintaining public health during the crisis and providing an economic balance so essentially necessary today. It is only through the whole-hearted cooperation of all the factors in the industry that the hoped-for results can be obtained. Now more than ever in a true cooperative spirit, manufacturer, jobber and service engineer must join hands in working out the solution to a satisfactory conclusion.

# Increased DIAPHRAGM LIFE PROLONGS THE SERVICE LIFE OF THE VALVE

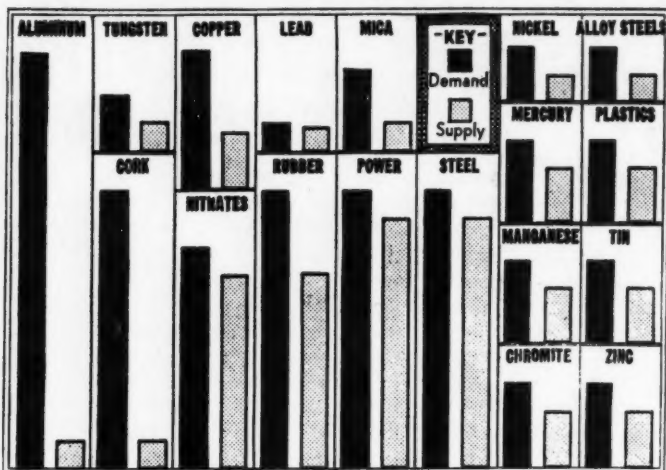
● Because of the small amount of movement, the multiple diaphragm in our Triple Seal Valve is never deflected past its normal center, thus immeasurably prolonging both its life and the life of the valve in service.

This valve has positive sealing at three essential points—a back seat with valve in open position—the multiple diaphragms—and the superior packing around the stem. This packing assures constant seal between pressure lines and diaphragm chambers.

One turn only completely opens or closes the valve.



# Industry Feels Material Shortage



Height of bars indicates the ratio of nonmilitary demand for certain materials (black bars) to the remaining supply (gray bars) after army and navy requirements have been filled.

Reprinted from Chicago Sunday Tribune.

The relation, naturally, between the jobber and the service engineer is closer because of their community of interests. Recently, C. E. Borden, President of the National Refrigeration Supply Jobbers Association, in outlining the efforts of his organization to maintain a source of supply for the industry, made specific recommendations which in part follow:

The "Refrigeration Service Engineer" recently noted editorially that the jobbers, along with other factors of the industry are doing all possible to maintain a flow of materials to the trade.

Without elaborating on our various activities it is enough to say that the N.R.S.J.A. is spending both time and money in this effort.

Your readers no doubt realize that "business as usual" is as defunct as the "dodo." Right now—in the preliminary stages of what Washington officials plan on as a five year era—we are decidedly short of copper tube, Freon, carbon tetrachloride, fittings, etc., and other shortages are imminent.

Our Jobbers Association has gone out of its way to solicit suggestions from the manufacturers in an effort to determine what we may do to ease the situation and cooperate with them.

Some points worthy of note by your members follow:

A. A severe shortage of refrigerant drums is approaching. It is necessary that all empty cylinders be returned to the Jobbers promptly if they are to maintain the desired service on this item.

B. Overdue accounts are now—more than ever—a liability to both jobber and service man. In this period, jobbers must anticipate their requirements to a much greater extent than usual; they must carry a larger stock than when deliveries are prompt. These stocks are carried for the trade—not for the jobber. It takes money to keep goods moving from jobber to service man—it takes even more money to keep goods moving from manufacturer to jobber due to the multitude and variety of items needed.

C. Manufacturers are waiting from one to six months for delivery of raw materials. Naturally this delay is passed on to the jobber. Accordingly, a thorough realization of conditions is necessary by the trade. Many items will be out of stock and prices are increasing. Manufacturers who find it necessary to back order on a jobber requisition must often bill the back order at the price prevailing when shipment is made rather than when ordered. Allow more margin in quoting on equipment sales. The catalog price is advancing rapidly and the jobber can give no price protection that he does not get himself. Allow for variations in material ordered from catalog descriptions. Manufacturers and jobbers are forced by conditions to give reasonable substitution.

In closing, let me say that the N.R.S.J.A. is striving to do the best possible job to protect all elements of the trade. We are willing to cooperate with the industry in any way possible and hope that we have your full confidence in the days that are ahead.

# POLARTRON

## *One Control*

**BUT...**

## **UNIVERSAL** *in* **APPLICATION**



*For*  
**DIRECT**  
**CONTROL**  
*up to*  
**1 H. P. A. C.**

### **EIGHT SERIES 40 POLARTRON ADVANTAGES**

Separate "On and Off" Knobs ★ Universal Range ★ Capillary Pressure Connections ★ Fewer Models to Stock ★ Cooling Control on Cut Out or Cut In ★ No Short Cycling ★ Minimum Free Service ★ Polartron Equipped Compressors can be Converted to Produce Frost-Free Constant Cold.  
Minneapolis-Honeywell Regulator Co. 2934 Fourth Ave. S., Minneapolis.

# **MINNEAPOLIS HONEYWELL**

## **REFRIGERATION**





# Refrigerant Drum ROUND- UP



The refrigerant drum shortage is acute but you can avoid a serious situation if you see that drums are returned to your jobber promptly. Let's "roundup" all of those drums that may have been long forgotten—they are **NEEDED NOW**. There is a possibility that the jobber may have to adopt a "no drum—no gas" measure. Do your part in alleviating this situation. "Round-up" your refrigerant drums. You can help to help yourself.

In a recent "round up" of refrigeration jobbers, before press time opinions vary slightly, but in the main they all agree that while the going may be a little tough, the service engineer's position in the industry today is more important than ever before and will be substantially strengthened by adhering to certain fundamental facts.

## Bring past due accounts up to date

—says F. S. Langsenkamp, F. H. Langsenkamp Co., Indianapolis, Indiana . . . You are doing a fine thing towards cementing a friendlier relation between the servicemen and jobbers by keeping the servicemen posted on the jobbers' problems. . . . Prices are changing constantly and daily and this coupled with the fact that people are apparently anxious to have their work performed immediately regardless of the cost should enable every serviceman to get a handsome profit on a cash basis. This is the ideal time for the service engineer to collect his long overdue accounts and in most cases he can get immediate cash from the customer for his work . . . From a credit standpoint, I believe every service engineer should make every effort at this time to bring his past due accounts up to date even though he should have to spend a little time and money collecting these right now, I believe it will pay big dividends in the end.

## Freon restriction too drastic

—says H. H. Hubbell, General Manager, Brass & Copper Sales Co., St. Louis, Mo. . . . On Freon, it seems to me that the restriction put in was much too drastic. We were cut down to one-quarter of our last year's purchases, and that certainly looks like bad management . . . On refrigerant drums, we have received a list from our source of all cylinders that are out and we are making an effort to have those cylinders returned where the age is too old.

In these days, certainly the wholesaler or jobber is going to take care of his most loyal and

best customers. One of the factors that makes a customer loyal and best is how he takes care of his credit obligations.

## Jobber is doing best possible in keeping stocks required for customers

—says Alex H. Holcombes, Victor Sales & Supply Company, Philadelphia, Pa. . . . It is our feeling that many substitutions will have to be made. In the past our customers have specified the make of valve, belt or gauge that they wanted. In the future they may have to take what is available. No jobber can tell how long he is going to be able to secure any given item. This is a war requiring metals and particularly the metals from which most of our products are made . . . If we can hold out until next year and with the proper cooperation from the OPM the maintenance of refrigeration equipment will probably weather the storm.

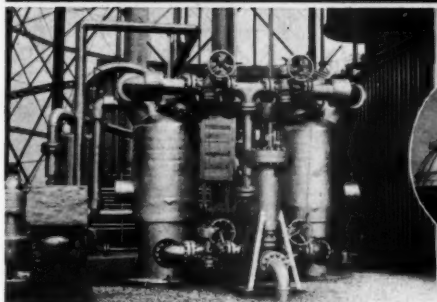
## Jobber is compelled to ration certain supplies

—says Henry W. Merkel, The Merkel Bros. Co., Cincinnati, Ohio . . . The manufacturer allots to his jobber customer a certain percentage of the best several years' average purchases. Under these circumstances, the jobber has to follow the same practice. This is necessary, too, particularly since the trade purposely orders more than they require or expect to get in the hope that they will secure a larger quantity than they really need. If anything can be done to discourage this practice, it will be very helpful. It creates a false demand. . . . Everything possible should be done to bring to the attention of the OPM that a very large part of the material sold by the jobber is necessary for the maintenance and repair of refrigerating equipment. The army is said to travel and fight on its stomach and the civilian population is expected to produce the equipment required for the defense of our nation.

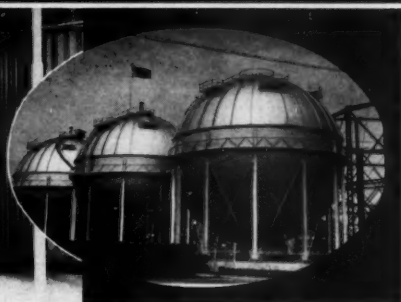
## Have been successful so far in supplying regular customers

—says H. R. McCombs, McCombs Refrigeration Supply Co., Denver, Colo. . . . This has been ac-

# "BIG TIME" REFRIGERATION USES ACTIVATED\* ALUMINA TOO



Lectrodryer units, charged with Activated Alumina, dry the gas DRY.



Each of these tanks holds 50 million cubic feet of natural gas liquefied.

Moisture can cause plenty of trouble in any refrigerating system. But on a job like this, where they don't dare take chances, they make certain this moisture is removed with Alorco Activated Alumina. Here's the story—

East Ohio Gas Company "refrigerates" natural gas until it becomes liquid—1/600th its normal volume—enabling them to carry gas storage when most needed to meet peak demands. Two Lectrodryer units, charged with Activated Alumina, dry the gas before it goes into the refrigerating system. Tem-

peratures finally get down as low as -248° F., but the moisture is out, so the system works without freeze-ups.

Big cooling job or small, Activated Alumina gives you this efficient, dependable drying service. And it removes acid from the system, preventing corrosion and reducing wear. Your supply house can furnish refrigerator cartridges charged with Alorco Activated Alumina. ALUMINUM COMPANY OF AMERICA (Sales Agent for ALUMINUM ORE COMPANY) 2159 Gulf Building, Pittsburgh, Pennsylvania.

\*Registered Trade-mark



*These manufacturers supply cartridges and dehydrators charged with Activated Alumina:*

American Injector Co.  
Fedders Mfg. Company  
Henry Valve Company  
Imperial Brass Mfg. Co.

Kerotest Mfg. Company  
McIntire Connector Co.  
Mueller Brass Company  
Cyrus Shank Company

★ ALORCO ★  
**ACTIVATED ALUMINA**  
DRIES REFRIGERANTS DRY 

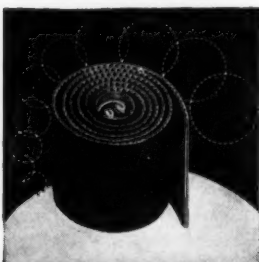


# MALLORY Universal AC CAPACITORS

...Reduce Investment...  
Simplify Replacements

There's no more certain way to make motor start capacitor replacements easier and more profitable than standardization on Mallory. They cover every replacement need... with half the inventory investment. Round types MSU are encased in the smallest possible metal containers. A specially developed "size adjuster" provides every diameter up to 3" and any height up to 4 3/4". You simply trim it at the desired places.

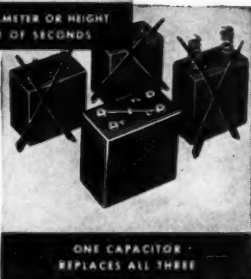
Rectangular types MSG and MSF are packed with complete hardware for every replacement requirement.



ANY NEEDED DIAMETER OR HEIGHT  
IN A MATTER OF SECONDS

Send for  
Catalog

Write today for  
Catalog M-801  
giving complete  
details and re-  
placement recom-  
mendations.



ONE CAPACITOR  
REPLACES ALL THREE

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INDIANAPOLIS INDIANA  
Cable Address — PELMALLO

P. R. MALLORY & CO., INC.  
**MALLORY**

complished for several reasons, first by knowing our customers' requirements and second, by rationing certain items such as dryers, tubing and Freon, which were impossible to obtain, to our regular customers and advising new customers to stick to their previous source of supply. Third, by substitution in some cases and fourth, by keeping our customers advised and cooperating with them as far as figuring out different applications and adaptations more than ever before... I think that more consideration should be given to the jobbers' stocks. If we must have a priority system, let us extend it to cover jobber stocks so the most good can be done in the quickest way for defense needs and necessary civilian needs. In other words, some effort should be made to see that jobbers' stocks are maintained instead of eliminated by priorities... The average independent serviceman cannot carry a lot of accounts on his books which at the best are difficult to collect because of so many adjustments and other things going wrong besides that part repaired. If he tries to do a credit business the first thing that happens is that he loses his credit and that so handicaps him that he is unable to take profitable jobs because he cannot get the material, and so on until he is just existing instead of having a profitable business. All he needs is intestinal fortitude to tell his customers it must be cash until he is in a position to invest money in accounts receivable, and by that time he will know the good from the bad and be able to keep his overdue accounts to a minimum.

A close cooperation between the jobber and the serviceman, dealers and contractors on all problems will find a well organized, profitable recognized industry come out of this dislocation that we are going through.

## Refrigerant drums situation is quite acute

—says Ted Glow, Central Service Supply Co., Scranton, Pa. . . . Various manufacturers have announced that there will be a rationing of supplies according to the 1940 jobbers' requirements, but have not announced what this quota will be. It would help matters considerably if we were to get specific quotas so we can plan our allotments for distribution. Copper tube, for example, has been rationed and the quotas cut twice... It is essential that servicemen maintain the resale schedule and get every bit of profit they are entitled to.

## Better understanding of each other's problems will materially help all

—says H. W. Blythe, H. W. Blythe Company, Chicago, Illinois... It is true that there are temporary shortages at the present time on certain items such as Freon, carbon tetrachloride, etc. When these shortages occur there is a scramble to obtain such items and, in some instances, over-buying results which only aggravates the situation and places an abnormal strain on the industry... Price changes are numerous and it is quite necessary that the service engineer keep this in mind when quoting on jobs where he does not have the material on hand.

And now a service engineer operating his own business in an average town has his say on the situation.

"I wonder how many of us have read the editorial in the June issue entitled 'We're in This Thing Together,' and I wonder how many more of us has sat down and read between the lines. There is much advice and much understanding to be obtained from this editorial. If you have read this don't fail to read it again as it contains information for all of us that within the next three years will be very valuable to other servicemen. I wish to ask that every serviceman give this editorial its fullest credit.

"In the present state of affairs, with Bill gone to the Army, and John too, you will just have to wait for your refrigerator until we can get to you; with the scarcity of trained refrigeration men and those that have been drafted into the service have added another hardship onto the independent service company as well as all servicemen. Vern Nold, Marion, Ind.



## The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment to "The Question Box."

### CORRECTION ON QUESTION 441

WE have noted with interest the answer to question 441, mixing gases, in July, 1941, issue of the REFRIGERATION SERVICE ENGINEER.

On the basis of adequate experimental work carried out in our laboratories, we beg to differ with you concerning the matter of mixing methyl chloride and sulphur dioxide. The statement—"the mixture, however, is not advisable and will cause considerable trouble due to the fact that methyl and sulphur mixed, combined with a normal amount of moisture which may be found in a system and various other conditions which are common to the operation of the system, will produce sludge, carbon, and a mixture known as resin." In the first place, perfectly dry methyl chloride and sulphur dioxide, when mixed, have absolutely no chemical reaction nor is there a chemical reaction between these two refrigerants if moisture is present. Any reaction which might occur will be between the individual refrigerants and the moisture in question. The normal amount of moisture present in a system could not therefore do anything to a combination of refrigerants which it could not do to either of the refrigerants if present alone. In other words, if there is sufficient moisture to cause corrosion with methyl chloride then a sludge will be produced which is characteristic of this particular refrigerant. On the other hand, if sufficient moisture is present to combine with the sulphur dioxide and thereby produce a sludge, then a sludge characteristic of this particular refrigerant would be found in the system. There is no interaction of the two refrigerants.

In Chicago, where acrolein is required, there is a real reason for not using a mixture of acrolein methyl chloride and sulphur dioxide. Acrolein, present in the methyl chloride, will combine with sulphur dioxide to form a "resin" with which you have doubtless become familiar, due to the fact that it does stick up a machine very badly.

The mixing of methyl chloride, free from acrolein, and sulphur dioxide therefore presents exactly the same problem, in general,

## "SHORTAGES" WORRY YOU?

Remember:

## THAWZONE DESTROYS MOISTURE!



In these days when there is a regrettable shortage of so many materials used in refrigeration service, it is a comfort to find an essential product, like THAWZONE,

which the trade has a good chance of being able to secure.

As far as we can see, we expect that THAWZONE will continue to be available to the trade, which has given this dehydrant such remarkable support during the past four years.

ASK YOUR JOBBER for Thawzone in original packages only, with the blue, white and black label.

Highside Chemicals Co.  
Newark, N. J.



# THAWZONE

Fully Protected by U. S. Patents

The PIONEER FLUID DEHYDRANT

ANSUL Chemical Company, an American business that has grown and progressed in the typical American way, is ready to serve your needs just as it is ready, if necessary, to serve the needs of the Republic. For 25 years Ansul has bent every energy to

the production of the finest refrigerants possible. We now face our second quarter century resolved that Ansul quality and Ansul service shall not be exceeded.

**ANSUL CHEMICAL COMPANY**  
 Marinette • Wisconsin  
 Agents for Kinetic's "Freon-12"

RS-24

**Ready  
to  
Serve**



**ANSUL**  
 SULPHUR DIOXIDE  
 ICE X  
 METHYL CHLORIDE

**THERE IS AN ANSUL JOBBER NEAR YOU**

as the mixing of "Freon" and methyl chloride.

There is one other phase of the mixing of sulphur dioxide with either "Freon 12" or methyl chloride which has not been dealt with in your answer to this question. Where methyl chloride or "Freon 12" have been treated with methanol, Ice-X, Thawzone, or similar anti-freezes, sulphur dioxide can not be added due to the fact that its mixtures with these anti-freezes are corrosive to common metals. This corrosion is very rapid and usually occurs within a day or so.

The principal result of the mixing of refrigerants, provided the machine is dry enough for operation with any one of the single refrigerants alone, comes from a change in the boiling points and pressures of the pure refrigerants. If only a little methyl chloride is added to "Freon 12" or vice versa, the result is a mixture which behaves very much like the principal constituent of the mixture. The same thing is true of possible combinations of sulphur dioxide and "Freon 12." Mixtures containing more nearly equivalent quantities of two refrigerants deviate to a larger extent, in their characteristics, from either of the pure refrigerants. It is in this zone that highly

erratic behavior of a machine containing a refrigerant mixture is encountered due to the fact that the refrigerants separate as a result of a definite distillation process.

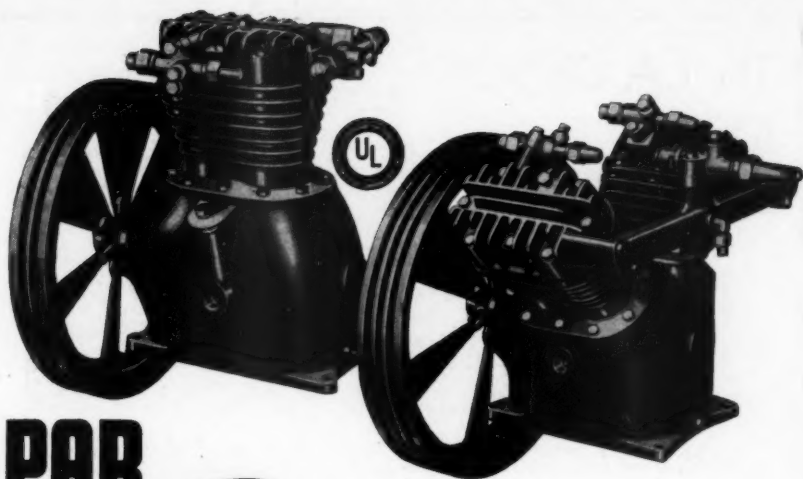
*Walter O. Walker, Research Director,  
 Ansul Chemical Co., Marinette, Wis.*

§ § §

#### REPAIRING GRUNOW COMPRESSORS

**QUESTION 443:** A large number of used Grunow household refrigerators have been shipped into this territory. Many are not in good order. We have worked on some, but without achieving a high percentage of good results. In many cases it seems to be lack of efficiency in the compressor, but we have no standard to judge this by. Can you give us the vacuum gauge reading that a Grunow compressor should be able to obtain while entirely throttled off on the suction side and operating against the atmosphere on the highside?

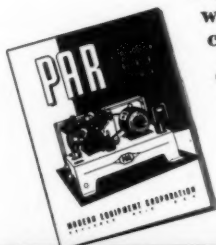
**ANSWER:** A Grunow compressor, under proper working conditions, pumping against atmospheric pressure with the suction side blocked off, should pump somewhere in the neighborhood of 29 inches of vacuum. However, a test of this kind, in my opinion, is valueless as an indication of efficiency under load.



# PAR

## The *Right* Replacement

- **RIGHT** . . . because these compressors are precision-built for long trouble-free service.
- **RIGHT** . . . because there is a size and type to suit every kind of installation—eight sizes, 2 and 4 cylinders, 1/5 H.P. to 10 H.P. for "Freon-12" or Methyl Chloride.
- **RIGHT** . . . because any refrigerating outfit will do a better job if the condenser is a PAR.
- **RIGHT** . . . because your original profit will not shrink from the expense of service call-backs.
- **RIGHT** . . . because you protect your reputation . . . insure your customers' complete satisfaction.



**Send for FREE CATALOG**  
or see PAR units on display at your jobbers.

MODERN EQUIPMENT CORPORATION • DEFIANCE, OHIO

## The LA CROSSE IDEAL DIRECT DRAW



This nationally recognized Direct Draw is available in two, three or four keg models as well as in combinations with facilities for bottle beer storage.

There is a reason why dealers are daily turning to La Crosse Direct Draws.

Write Department RSE-418 Today for Complete Literature

**LA CROSSE NOVELTY BOX MFG. COMPANY**  
**LA CROSSE, WISCONSIN**

It is quite possible that a compressor will pump a vacuum of 29 inches and yet fail entirely when placed under actual working conditions. This is because, while it can handle a low vacuum, it will not handle a large enough volume of vapor to supply the required amount of refrigeration. These Grunow compressors seem to be subject to collecting a certain amount of film on the working parts of the compressor. The deposits may take the form of a carbon, a copper coating, or just hard materials that have become attached to the working surfaces.

For this reason, it is a good practice to thoroughly clean the compressor, washing it out with carbon tetrachloride, and then rehone the blades and other working surfaces of the compressor until they are smooth and bright.

This type of compressor depends upon very accurate and fine clearance between the side of the blades and the body of the compressor. If the clearance is too great, the compressor will lose considerable efficiency.

### RECONDITIONING SHELVES

**QUESTION 444:** If at any time you have published any information telling how to recondition shelves that have rusted in used

refrigerators, we would be glad to have you send us this information. The matter of reconditioning trade-ins is a serious problem, and the rusted shelves is the item that is bothering us most just at this time. We would be pleased to have any information you have on this matter, or have you tell us where such information can be obtained.

**ANSWER:** I don't seem to recall any published information which would describe the reconditioning of refrigerator shelves. However, the usual method is to clean the shelves in a fifty per cent solution of muriatic acid and water in order to remove the rust, then have them tin-dipped. This, however, can only be done where the cross bars are welded and not soldered.

If they are soldered, the tin-dipping process would melt the solder and permit the bars to fall away from the frame. Most of these shelves, however, are spot-welded, and tin-dipping in this circumstance would be the best method of reconditioning them.

An easier and perhaps less expensive method is to have them electro tin-plated, and this method is the only alternative you have if the cross bars are soldered in place. Another method, which may be considered cheaper yet, and of course, will not last as

*(Continued on page 48)*

# "FACTORY FRESH" AMINCO SUREDRIY DEHYDRATORS



## "TAMPER-PROOF" SEALED

"Factory Fresh" means that Aminco Dehydrators are protected with plastic tamper-proof seals so that all the powers of adsorption and absorbing remain intact—right up to the minute the dehydrator is placed in service.

Sealing as done by Aminco insures against picking up moisture from the air—against deterioration in stock—and provides fresh, active dehydrating qualities from the beginning of employment on the job.

Other notable features are:

- One piece copper shells.
- No joints or threads to cause pockets or leaks.
- Filled with Silica Gel—the fast

acting drying agent that does not cake or powder.

- Labyrinth Filtration, with Five times the filtering area of the screen surface of wire cloth.
- Inlet filter full diameter of shell.
- Outlet filter on refillable models is a cone of equivalent surface area to inlet filter disc.
- Refillable and permanent models in all wanted sizes.
- Dehydrated and sealed after final assembly.

### INSURE

Reduced Pressure Drop  
100% Filtering Efficiency  
Positive Dehydration.

*At all good jobbers.*

*Send for Bulletin No. 23.*

## AMERICAN INJECTOR COMPANY

1481 Fourteenth Avenue

DETROIT, MICHIGAN

Pacific Coast: Van D. Clothier, 1015 E. 16th, Los Angeles, Calif.

Export: Borg-Warner International Corp., 310 S. Michigan Ave., Chicago, Ill.

## Fundamentals of Motors

(Continued from page 24)

Repulsion starting operates on this principle. Current is caused to flow in the wires of the rotor winding and these wires are affected by a magnetic field. Fig. 16 illustrates a stationary "C" shaped iron core on which is mounted a coil connected to a single phase supply line. In the opening of the "C" is a ring of iron on which is wound a continuous uniform coil. The path of the magnetism, produced by the first coil, is around through the "C" shaped core and then, dividing equally, half of the magnetism passes through each half of the iron ring.

The winding and the magnetism are identical in both halves of the ring. Thus any effect which the magnetism may have on the winding between A and C should be the same as that produced in the winding between A and D. By test, connecting C and D together through an ammeter, it can be demonstrated that this is true as no current flows when a wire is connected between C and D. By further similar tests it can be shown that the maximum current will flow when a wire is connected between A and B. Thus the first requirement of our principle has been satisfied—with a wire connecting A and B there is current flowing in the rotor winding.

Assume that the current flows upward in this wire from B to A. At point A it divides equally, half going to the winding to the left of A and the other half to the right. Referring to the wires on the outer surface of the ring, those on the right have

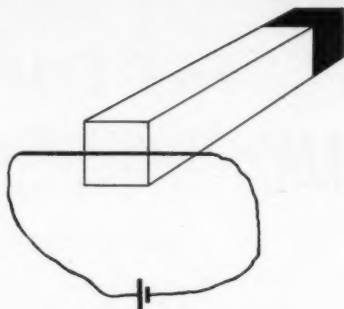


FIG. 15.

the current flowing towards the observer while those on the left have the current flowing away from him. Thus the magnetic field from the "C" shaped core tends to force the wires on the right in one direction and those on the left in the other direction. The forces are equal and opposite so that they neutralize each other and no motion takes place.

It is therefore necessary to add a magnetic field that can effectively react with the current in the rotor winding. This is readily done by adding another "C" shaped core with its coil as shown in Fig. 17. The rotor winding current under each tip of this "C" shaped core is all in the same direction and rotation is obtained. The wire from A to B, in Fig. 16, has been replaced with stationary brushes so that it continues to maintain this connection as the rotor turns.

The reversing of single phase motors may

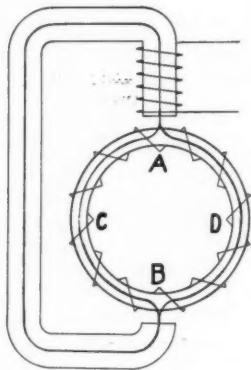


FIG. 16.

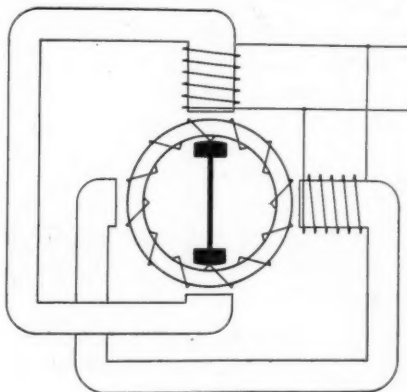


FIG. 17.



# "I find it hard to do without," so says this service man

• Now that the Calculator is being put to the test of practical use in the field, we have had a number of letters from service men testifying to its value. This one is typical.

## WRIGHT'S H. B. P. CALCULATOR

The purpose of the Head-Back Pressure Calculator is to quickly determine the proper head pressure, for the following refrigerants when the suction pressure, room temperature or mean water temperature is known.

Carrene	Methyl
Isobutane	Freon or F-12
Sulphur Dioxide	Ammonia
Carbon Dioxide	



Actual Size 3 1/2" x 3 1/2".

Raton, N. Mex.  
Enclosed please find \$1.00,  
please send me your Head-Back  
Pressure Calculator.  
I lost mine and find it very  
hard to do without.  
Yours truly

*Merle Rankin*

## A Vestpocket Tool Every Service Man Should Carry

A number of troubles can be detected by comparison of the existing head pressure and what the head pressure should be, but in the past there has been no convenient method available to the service engineer to determine what the correct head pressure should be. Such variable conditions as the suction pressure, room temperature, water inlet and outlet temperature, kind of gas used, etc., all determine the proper head pressure. It is not practical to depend on one's memory of other similar conditions or to just use snap judgment when this handy calculator gives you the correct answer so easily. Send for it today! Sturdily constructed, with oil-proof finish, for on-the-job use.

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be of incidental interest. Split phase and capacitor motors are reversed by reversing the connections to either one of the two stator coils. Repulsion start motors are reversed by shifting the brushes, originally connecting A and B in Fig. 16, so that C and D are connected. The "C" shaped cores exchange their functions of generating current in the rotor winding and developing

rotational force. The reversal of the shaded pole motor is accomplished by disassembling the motor and reassembling it with the shaft extending from the opposite end.

The principles of motor operation, if thoroughly understood, are helpful in work with motors. With a full appreciation of how and why a motor functions, we are better able to attack service problems.

## QUESTION BOX

(Continued from page 44)

long, is spraying or dipping the shelves in one of the metallic paints on the market, such as aluminum paint. I believe that a great number of the service companies use this last method when they are reconditioning old refrigerators.

### SERVEL HERMETIC

**QUESTION 445:** I have a Servel hermetic unit of the household electric type, about a 1932 model. This unit runs for a few minutes and shuts off for a few minutes. The evaporator frosts up good, but it will not freeze ice solid in the trays. It only partly freezes them, and the lower tray is the slowest one to start freezing.

I had the cold control rebuilt which should be all right, and it is set for the coldest position. I have a gauge hooked up on the suction line and the motor stops when the hand is around five pounds pressure; when it starts again, it seems to me that the compressor does not pull the pressure down to that point fast enough, because just about the time it reaches that point, the machine kicks off. The suction line frosts for about two feet just before the machine kicks off.

Perhaps I have bad valves in the compressor, or too much gas, but I hate to go into that much work in dismantling the compressor to find them good, for there is no way on this machine to test the head pressure or the condition of the compressor.

Please let me know your opinion as to what you would try first to remedy the trouble.

**ANSWER:** If, as you say, the unit cycles properly, but you are not getting a low enough temperature in the evaporator, I would be more inclined to believe that your troubles are due to conditions in the evaporator rather than to the compressor valves or any condition within the compressor itself.

The first indication would be that the thermostat is not set low enough, and even

though you had this temperature control overhauled, it is quite probable that the setting of it is too high for this application. If there is any method through which you can change the indicator dial on the evaporator while at the same time setting the control itself to a colder position, I believe that this would help. According to the manufacturer, with the regulator set at "chilling," the temperature on the lower conductor plate in the evaporator should register 14 degrees. This conductor plate, as you probably know, is the second shelf from the bottom of the evaporator.

There is another possibility, however, and that is that oil has become logged in the evaporator, although this seems to be an unreasonable possibility since you are getting liquid returning on the suction line, as indicated by the frost on the suction line, and oil should return with it. It may be that the oil is just beginning to return when the compressor shuts off; therefore, in an effort to try to get this oil back, or to determine whether or not there is oil there, I would suggest that the thermostat be blocked in the closed position, keeping the unit running until the temperature of the evaporator reaches about 10 degrees. At the same time, I would watch the suction line to determine whether or not the frost line extends a greater length in the direction of the compressor, or whether it disappears from sight into the evaporator. If it does disappear from sight, probably it means that oil is in the evaporator and that you are gradually getting it to return, and as it leaves the evaporator you are getting an indication of the shortage of refrigerant by the fact that the frost line is disappearing.

As this frost line disappears, then it would be necessary to add more refrigerant until eventually the frost line remains constant at one place, regardless of how long you run the compressor. Once the oil has been returned to the compressor and sufficient refrigerant is being held in the evaporator, there should be no more trouble with oil logging.

# Refrigeration Service Engineers' Society

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

## ILLINOIS STATE ASSOCIATION CONVENTION

THE fourth annual convention of the Illinois State Association will be held October 19 and 20, in the Leland Hotel, Aurora, Illinois.

Plans are rapidly being completed for the entertainment of the attendance and the educational program is in the making.

\*\*\*

### MARJORIE SUE ARRIVES

MARJORIE SUE GOLDBERG, eight pounds of girlish beauty, arrived July 29th on the 4 A. M. special to be met by her beaming father, Herman Goldberg. Marjorie's mother, Mollie, also present, is doing well and is duly proud of the arrival. Brother Louie is looking forward to an early meeting and a great deal of future companionship. Congratulations are pouring in to Herman and Mollie Goldberg from their many friends.

\*\*\*

## R. S. E. S. Chapter Notes

### ROCKFORD CHAPTER

June 7—Both this meeting and the meeting of July 21st were devoted almost entirely to business of the chapter which included financial reports, reports of committees and a good deal of discussion.

### OIL CAPITAL CHAPTER

May 30—The meeting was called to order by E. H. Churchwell, President. After a

short business session it was turned over to the educational committee and Mr. Dawson of the Alco Valve Company presented an entertaining and informative program centered around a demonstration refrigerator unit with special Alco valves. This part of the program continued until 9:40 P. M., then a second business session was held ending at 10 P. M.

### TWIN CITIES CHAPTER

July 1—The greater part of the meeting was devoted to chapter business and to the appointment of committees and final arrangements for the forthcoming annual picnic. Plans were being made to accommodate as many as one thousand persons and the committees were working toward the end of securing such an attendance. Tickets were being sold by two teams, representing St. Paul and Minneapolis. After the business session was completed, the meeting was turned over to Mr. Richards, who conducted an interesting quiz program. A. M. Palen and Lee Miles tied with the honors, receiving seventy-five cents each, while Perry Copeland won thirty cents.

### SAN DIEGO CHAPTER

June 27—On the educational program for the evening Penn Electric Switch Company provided a full evening's entertainment with their demonstration board. Every member of the chapter was present for the meeting and in addition there were approximately 35 guests. Mr. Luscombe of the Penn Company presented a very fine talk enjoyed by the entire audience.

June 10—A regular meeting of the chapter

## PLAN TO ATTEND THE R.S.E.S. CONVENTION IN CHICAGO, JANUARY 12-15, 1942

IT is none too early to plan your trip to the Chicago Convention. More than ever before it is imperative that you take this annual opportunity of securing new ideas and of seeing the newest products of the industry. What to do to offset the shortages of labor and materials, and what substitutes are available, are going to be pressing questions this year, and there is no better place to solve them.

was held at the business place of one of the members as is the custom of the chapter. For some time during the past these meetings have been alternated between the business establishments of the members and the plan seems to be working very nicely. A large banner, approximately three feet square with a replica of the R.S.E.S. emblem, has been made and is displayed on the front of the building where the meeting is to be held. As a means of identification to the attendance, the banner remains on the building for a period of two weeks following the meeting until it has to be removed to the next place in time for the next meeting.

#### CENTRAL NEW YORK CHAPTER

*May 28*—The meeting was called to order by President Harder and the minutes of the previous meeting read and various other miscellaneous business matters completed. The balance of the meeting was devoted to the annual election of officers and those elected were as follows: Weldon Andrews, *President*; Robert H. Wilson, *Vice-President*; Henry Jenda, *Secretary*; Fritz Harder, *Treasurer*; William Wermuth, *Sergeant-at-Arms*.

*June 11*—The meeting was called to order by the newly elected president, W. Andrews, and during the course of the business session the financial report was given by Treasurer P. Cross and various other committees made their annual reports. Plans and arrange-

ments were begun for an annual picnic to be held at the Andrews farm. A committee was appointed to complete arrangements and authorization was given to draw on the treasury for expenses.

*June 29*—The annual picnic of the chapter was held on this date at President Weldon Andrews' farm at Truxton, New York. A caravan of about fourteen cars left Salina and Seneca at 10:30 A. M. A total of approximately 70 people enjoyed the athletic games and contests provided throughout the day. These contests and winners were:

Hog Calling Contest, won by Ray Wall. The prize was a Purging Hose donated by Central Service Supply Company.

Sack Race Contest, won by George Capron. The prize was a Detroit Expansion Valve donated by Edward Joy Company.

Shoe Race Contest, won by Edwin Miller. The prize was a Thermostat donated by Minneapolis-Honeywell.

Hammer Throwing Contest, won by Paul Cross. The prize was handkerchiefs donated by President Andrews.

The Dairylea Ice Cream Company, through Paul Cross, provided the picnic with a gross of ice cream cups greatly enjoyed by everyone present.

*July 16*—During the course of the business session a complete financial report on the picnic was provided, indicating that while an extremely good time was had by all, the total cost was negligible. President Andrews then appointed committees to carry



#### Milne, the Fisherman

**I**F you thrill to the tug of a fighting rainbow trout on the line, you will appreciate this picture of an unusual catch. You may also be interested in where such fishing can be done and it is even possible the fisherman may tell you.

H. M. Milne, Modern Household Appliances, Ltd., Westmount, Quebec, Canada, and two of his friends were the fishermen and the catch was made during a three day stay at his camp. A total of 208 fish were caught, 187 of which are displayed in the picture. The prize of the lot, weighing one and one-half pounds, is held in Mr. Milne's hand.

# Commercial Refrigeration and Comfort Cooling

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Chronologically, the author points out the various considerations in the proper refrigeration of the most commonly refrigerated commodities, such as fruits and vegetables, meats, dairy products, fish, frozen foods, beer, flowers, furs, ice cream, water cooling, quick frozen foods, etc.; the selection of lowside equipments, types of refrigerators, simple formulas for figuring load calculations; a discussion on highsides, valves and controls, as well as pertinent information on comfort cooling.

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on work of the chapter during the remainder of the year, consisting of Bob Wilson, John Just and Ivan Thorne on the Membership Committee; Nick Andrella and John Debes on the Sick Committee; and John Debes, Maurice Schwartzberg, Fritz Harder and Ted Glou on the Educational Committee.

#### SIoux CITY CHAPTER

The annual meeting of the chapter was held at the Jackson Hotel. A fine steak dinner preceded the meeting and during the business session Frank Kutil, *President*, presided. The annual election of officers took place with the following results: Harold Eriksen, *President*; Murlin Mosier, *Vice-President*; A. L. Ricard, *Secretary*; J. W. McCarthy, *Treasurer*; Scott DeMotts, *Sergeant-at-Arms*; Frank Kutil, *Education Chairman*.

After the business session was completed, Mr. Kutil carried the meeting on into an interesting question period, taking the form of a quiz contest. Those who took part in the contest seemed to enjoy it and it was the general opinion that more such programs should be held in the future.

#### WESTERN MASSACHUSETTS CHAPTER

*June 25*—The meeting was held at the Hotel Bridgeway and the primary business of the meeting was the annual election of officers. Those elected were as follows: Arthur D. Hebert, *President*; William J. Plante, *1st Vice-President*; Errol Putnam, *2nd Vice-President*; Harold M. Warner, *Treasurer*; Earle W. Fassell, *Secretary*; James A. Bertram, *Sergeant-at-Arms*; Harold Ouimet and James Vye, *Educational and Entertainment Committee*; Mr. Adams, Harold C. Lambert and Walter Quimby, *Directors*.

#### ONTARIO MAPLE LEAF CHAPTER

*June 22*—The annual picnic was held at Huttonville Park and turned out to be a major success, although during the afternoon, short interruptions were experienced due to heavy rain which lasted only a few minutes at a time. The numerous events planned for the picnic were well supported by both children and adults. Many of the events and informal movie reels were taken by our camera enthusiast, W. J. Christman, and it is hoped that we will be able to have these presented on the screen at one of our regular meetings in the Autumn. The events of the day consisted of races for the kiddies, young boys and girls, three-legged race for men, egg race for women, lucky draw prizes, baseball and swimming, for those who felt so inclined. There was fun galore and will, no doubt, be long remembered by those members and friends who were present.



## Ladies Auxiliary

### CENTRAL NEW YORK AUXILIARY

*May 14*—The meeting was held in the Polish Community Home and because the attendance was small no business was conducted and the meeting was finally removed to the home of Mr. and Mrs. Harder where an impromptu good time was enjoyed and refreshments were served during the evening. Mr. Harder and Mr. Andrews both entertained the gathering with music on an accordion.

*May 28*—The meeting was held at the home of Mrs. Andrews and the discussions of the meeting centered around plans for a basket picnic. The location of the picnic was decided upon as the Andrews farm at Truxton, New York, the date, June 29th. After the meeting the men's chapter joined the ladies in refreshments.

*June 11*—Further plans for the picnic were discussed and plans were started on the forthcoming state convention to be held in October.

*July 16*—A complete report was given on the annual picnic which showed that everyone enjoyed themselves. Some discussion arose on ways and means of increasing the treasury funds and it was suggested that a sunshine box be provided for each meeting. Each member to pay 10c into it for each meeting. Mrs. I. Thorne was elected custodian of the box.

### ROCKFORD AUXILIARY

*June 2*—During the business part of the meeting President Henley of the men's chapter came in and discussed picnic arrangements which were already being planned by the men's chapter. The ladies were asked to take charge of the games and purchase the prizes. The men's chapter provided the funds. The auxiliary decided upon purchasing a bedspread which would be raffled at the picnic. A committee of two was appointed to make the purchase and arrange the raffle books. Following the meeting "Airplane Bunco" was played with Mesdames Overman, McCarthy and Wendt, the winners.

*June 16*—The Committee appointed for the purpose of purchasing the quilt and arranging the raffle tickets brought the quilt to this meeting and started selling tickets. Blocks of tickets were given out to various members of the men's chapter and several of the ladies took books with them. It was decided that an attendance prize of a pair of hose be provided for one of the lucky ladies in attendance. After adjourn-



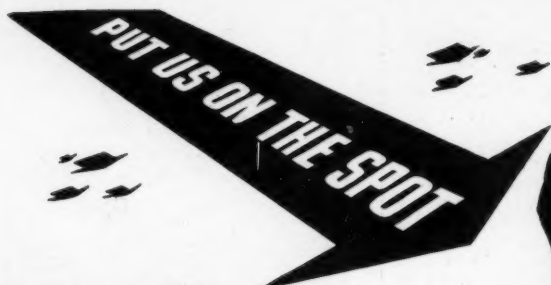
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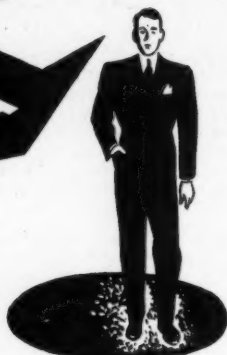
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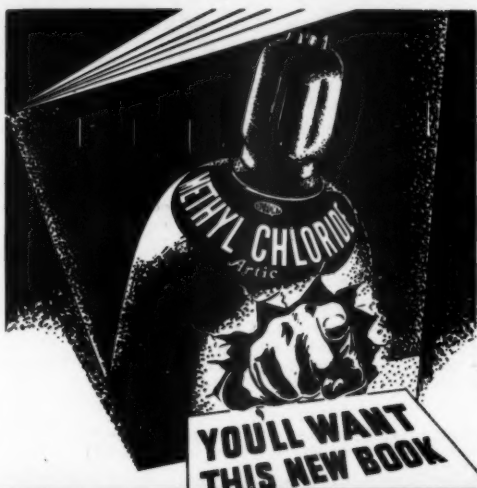
ment of the meeting "Coottie" was played with Mesdames Kruse, Larson and Overman winning the prizes.

July 16—After the minutes of the two previous meetings had been read and various correspondence disposed of, an election for sergeant-at-arms was held. Only one name was suggested for this office, therefore, the secretary was instructed to cast one unanimous vote for Mrs. Wendt as sergeant-at-arms. At the suggestion of one of the members, it was decided to hold a dinner for the members on August 4th, the location to be the Wagon Wheel. Part of the expense for the dinner to be drawn from the treasury while those in attendance would stand the balance. The remaining part of the evening was spent in playing "Hearts."

\*\*\*

### MIDWEST JOBBERS MEET

THE Midwest Refrigeration Supply Jobbers held a meeting in Des Moines, Iowa, on Sunday, June 22. Many important subjects were discussed at this meeting. Those attending were: Howard H. Hubbell, Secretary of the Nat'l Ref. Supply Jobbers Association; E. L. Bengston, Republic Electric Company, Davenport, Ia.; W.



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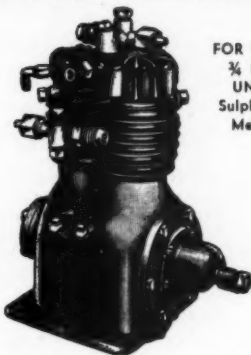
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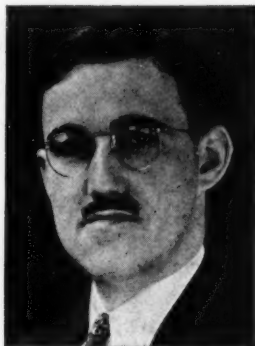
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"The  
**USE OF WELDING**  
in **SERVICE REPAIR**"

## PAGE 13

of this issue to see why **WELDING** is becoming increasingly important in Refrigeration service work. Then, let U.E.I. which specializes in **BOTH** Welding and Refrigeration teach you welding **AT HOME**, during your spare time.

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### WAGE AND HOUR LAW INTERPRETATION BROADENED

**I**N a recent revised interpretive bulletin issued by the Wage and Hour Division, U. S. Department of Labor, certain interpretations of the law were further outlined to clarify those establishments subject to

# Chieftain . . .

## A NAME TO REMEMBER

Chieftain—a name that is only six years old, yet represents one of the most outstanding achievements in the refrigeration industry. It is a name that has been placed on over a million compressor and condensing units. It is a name you will always associate with the highest quality. It is a name to remember for greater profits.

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the Wages and Hour Law. In brief, the bulletin stated that the U. S. Department of Labor will not regard any establishments exempt as retail establishments unless 75 per cent of their sales are retail. Where wholesale commercial and industrial sales non-retail in character, total more than 25 per cent, the 40-hour week and the 30-cents-an-hour minimum wage will apply.

The bulletin further states, "At the same time, the Division will broaden its concept of a 'retail sale'. As a result, some sales to industrial or commercial purchasers may be included as retail in determining the status of an establishment under the Wage and Hour Law. These sales must be of articles commonly sold to both business and private purchasers, and must be in a quantity, or at a price, similar to sales to private purchasers."

Under a heading, "Service Establishments," the revised bulletin states that the position of the Division in respect to the term "may be considered to include generally that large miscellaneous assortment of business enterprises which are similar to retail establishments in character, but which may not be accurately classified as such." A number of typical examples of these service establishments are listed which includes,



## P ROTECTION

• Your interests are the concern of the N.R.S.J.A. jobber, identified by the emblem above. He recognizes you as a logical factor in the economic and satisfactory installation of refrigeration equipment and supplies and co-operates fully with you.

His business is dependent upon your success. Make the N.R.S.J.A. jobber your partner. The emblem shown above identifies his interest in your protection.

**NATIONAL REFRIGERATION SUPPLY  
JOBBER ASSOCIATION**

# HERMAN GOLDBERG CO.

MANUFACTURER'S AGENT



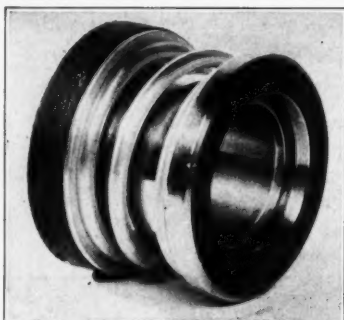
**RANCO**  
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Standard Evaporators • D. F. N. Dehydrators  
Chicago Seals

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When Other Seals Fail Try

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**SHAFT SEALS**

ON NEW—AS WELL AS ON OLD,  
WORN AND SCORED SHAFTS.

A Complete Line.

See Your Jobber.

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among others, household refrigerator service and repair shops.

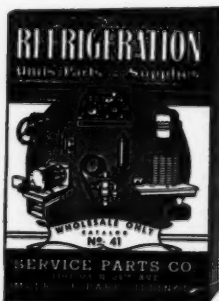
It must be clearly understood that service establishments, to be classed as retail outlets, generally repair consumers' goods owned by the general consuming public. It further states that "In some cases, however, an establishment repairs the type of goods which the general consuming public ordinarily does not own," and mentions as examples building elevators, production machinery, commercial refrigerators, and so forth.

\$\$\$

## THAWZONE TESTED IN HERMETICS

**H**IGHSIDE CHEMICALS COMPANY has just made available to their representatives a report on some of their tests on Thawzone in connection with hermetic units.

Samples of enamel covered wire from various types of hermetic unit motor were obtained and sealed in glass tubes with Freon, oil and Thawzone. These were stored for six months at temperatures from 40° to 120° F. At the end of that time the wire samples were removed and examined carefully. The results are tabulated in Table I.



## HERE IT IS

THREE  
CATALOGS  
IN  
ONE

1. Hermetic Units  
Compressors — Parts
2. Parts — Compressors — Evaporators  
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These tests correspond to the recommended proportions of 2 cc. or  $\frac{1}{40}$  ounce

TABLE 1.

Test No.	Temp.	Wire Sample	F-12	Oil	Thawzone	Wire and Insulation
1	120°	1	20 cc. 1 cc.	.1 cc.	OK	
2	120°	2	20 cc. 1 cc.	.1 cc.	"	
3	70°	1	20 cc. 1 cc.	.1 cc.	"	
4	70°	2	20 cc. 1 cc.	.1 cc.	"	
5	70°	3	20 cc. 1 cc.	.1 cc.	"	
6	40°	1	20 cc. 1 cc.	.1 cc.	"	

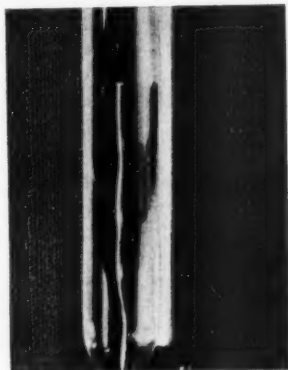


FIG. 1.

## PRACTICAL

### EASY TO TEST AND CERTIFY SERVICE WORK with this

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Simplify your service work this easy, accurate Practical way. (1) Locate trouble. (2) Test installations. (3) Prove the correctness of your service work and end complaints . . . with complete 24-hour graphs permanently recorded in ink on paper charts. Portable . . . always ready to go anywhere, anytime. Sturdy, guaranteed.

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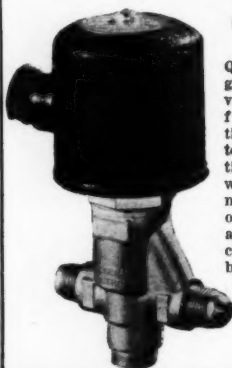
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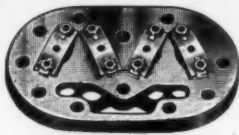
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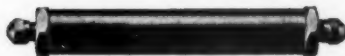
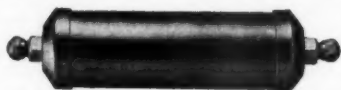
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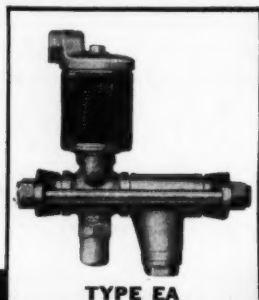
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tions so that new sections and supplements may be easily added.

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THE REPUBLIC ELECTRIC CO., Davenport, Iowa, has issued a new 150 page catalog listing all parts, repairs and supply needs for the refrigeration service engineer. According to the Republic Company, this new edition is more complete and more convenient to use than ever before. A great deal of thought, expense and hard work has gone into the preparation of this book. It is their wish that their customers will find it a daily help.

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